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SOME DISEASES OF PIGS.

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SOME of the complaints most frequently causing losses in pigs are considered briefly below :—

Troubles with Baby Pigs.—Pigs being born dead is not an uncommon happening. In some cases the little pigs are fresh, full size, and normal. These pigs were probably alive at commencement of birth, but were smothered in the membrane. If attention had been given when they were being born, the membrane removed and the nostrils cleaned, they might have been saved. In other cases there is evidence that the pigs have been dead within the mother for six weeks or so. In many cases the cause can only be surmised. However, a check in the nutrition of the pregnant mother is one definite cause. A similar condition has been seen in lambs born of ewes which earlier in pregnancy had a check and were short of food. One has seen it occur in sows running out, where the feed-grass became dry and unnutritious, and no supplement was allowed. Iodine shortage in certain areas in the United States of America has been associated with little pigs being born weakly or dead. Evidence of this (goitre, hairlessness) has not been noted here, but one large breeder said that since feeding iodine to pregnant sows, he had fewer weakly pigs born.

Contagious abortion infection has not so far been found in pigs in New Zealand. Therefore to avoid losses with baby pigs one should see that the pregnant sow, without becoming too fat and lazy, is getting sufficient nourishment, particularly protein, that adequate minerals are available, and it may be advisable to give a trace of iodine at intervals.

Deaths in Pigs at One or Two Days old.—Some of these are undoubtedly due to management. The sow should have a certain amount of laxative food just before and after farrowing. She should not be overfed; in fact, kept rather short for a day or two, provided sufficient fluid is available. Constipation should be guarded against. The udder should be clean, so that when little ones first suckle they do not get a mouthful of filth. Some believe in taking the piglets away while the sow is farrowing, and this may prevent some being crushed, but if it is done they must be kept warm and comfortable. The sow should be disturbed as little as possible during the first couple of days, since nervous sows become upset.

In many cases scours in little pigs can be traced to feeding of sow. Excess of diet high in protein, a change of diet, too many roots. In

one case where conditions were otherwise ideal, the sows were eating very succulent young grass, in certain runs. It was found that scours were prevalent in all the little pigs, but did not affect the few litters the mothers of which were in somewhat barer runs. In other cases the scour is of an infectious nature, sometimes definitely due to *Bacillus suipestifer*, to be mentioned later. In one outbreak of this trouble where sows were being farrowed in sties, all efforts in the way of altering diet, &c., of the sow failed to check the trouble, till the method was changed and the sows farrowed in portable houses in fresh runs.

To correct any of the above defects, regulate the feeding of sow carefully. If treatment is required, try smearing sow's udder with a solution of citrate of iron. The following has also been used with benefit, viz.: Sulphate of iron, 3 drams; sulphate of copper, 1 dram; water, 1 pint. Dose: 1 teaspoonful.

Bacillus suipestifer Infection.—In the Waikato this has been the disease most often present where numbers of pigs were dying. It is essentially a dirt disease and may cause considerable loss where pigs are kept under insanitary conditions. The organism is evidently a common one round old yards and sties, and may be present in normal pigs. It has considerable powers of resistance. The disease is occasionally met with where pigs are under good and clean conditions, but only one or two deaths will occur. The organism becomes harmful only when the pig's resistance is first lowered by other factors such as unbalanced feeding, sudden lowering of temperature due to change in weather or exposure, journeys to or from sales, consequent changes in diet, &c. Dirt is an important factor, playing a part in accumulating numbers of the germs, and distributing them from pig to pig via feeding-troughs, as infection probably takes place chiefly by swallowing the organisms in dirty food. The young pig is the chief sufferer—either the sucker or more often the young weaner from eight to twelve weeks. In the United States of America the disease is believed to be the chief cause of loss amongst pigs about this age.

The symptoms vary considerably in different animals and in different outbreaks. For descriptive purposes we may divide them as relating to (1) the chest; and (2) the digestive tract; though any combination may be found. In the first class, pneumonia is very frequent. Probably the majority of lung cases in pigs is due to this cause. Affected pigs usually show breathing somewhat hurried with a jerking movement of the flanks; there is some nasal discharge and usually a cough; condition is lost fairly rapidly. Appetite may be retained, and, among a large mob, the earlier symptoms may be overlooked. Then the pig is reported to have died suddenly, but a post-mortem examination will show that pneumonia has been present for some days. At other times the acute symptoms subside, but the pig continues unthrifty and stunted, and may die at any time from heart weakness. In other cases recovery may be apparently complete. Where the digestive organs are affected, which seems to happen more often in outbreaks amongst the younger pigs—suckers or pigs recently weaned—there is usually diarrhœa, condition is lost even more rapidly and death in suckers may follow quickly. Appetite is very capricious and food may be refused. On examining a pig dead from this disease, the skin of ears, belly, and inside thighs may be seen to

be dark-red or purplish, due to weakened circulation. On opening it, the lungs are frequently found to be more or less solid and adhering to ribs—pleurisy. The sac containing heart is frequently distended with fluid, or may adhere to heart. The stomach lining is very frequently inflamed in patches. If the bowels have been involved, the wall of the large gut will be thickened with ulcers on membranes on inner surface. This form is referred to as necrotic enteritis.

Attempts at treatment are less important than preventive measures. However, affected pigs should be separated from the rest so that they will be undisturbed, provided with bedding, and allowed a diet of whole milk, molasses, and lime water. Where scouring is noted, as in suckers, results have been obtained from small teaspoonful doses of 2 drams sulphate of iron and 1 dram bluestone in a pint of water. As a practical measure it is better to remove the apparently healthy pigs from the pen into a clean run. The feeding must be adequate; cod-liver oil, ½ oz. per pig, may be added for a week, together with bone-meal and a little citrate of iron solution, but cleanliness is most essential. Any chronic cases which are unduly stunted, or in which the respiratory symptoms persist, should be destroyed, as they are unprofitable to rear and are a source of infection to others. If the yards have been in use for a number of years, or are dirty, this disease, once it gets a foothold, is likely to cause considerable loss year after year and either a new location must be found for pig-runs which is advisable, or at least all affected runs should be broken up and spelled from pigs for a season by growing a root crop on them.

Pasteurellosis.—This is sometimes called infectious pneumonia, since pneumonia is a common but not constant feature. It is also known as swine plague. The cause is an organism which becomes active mainly as a result of some sudden lowering of vitality. Recent experience suggests that this disease is more likely to occur as an outbreak following the introduction of new pigs. Exposure at sales, transport, and irregular feeding and change of diet, reduces the powers of resistance in these pigs and the organism is enabled to set up disease; at the same time its virulence is apparently increased, and infection may be carried to, and disease set up, in previously healthy pigs coming in contact with the new ones. The importance of isolating new purchases for about ten days is thus seen.

In acute cases fever with high temperature and marked depression may be noted only a short time before death occurs. More often symptoms of pneumonia are seen—hurried breathing, &c., with depression. Examination of a pig dead of this disease may show very little if in the acute stage; probably solid areas of lung if in a later stage. To determine the presence of this trouble with certainty material must be submitted to the Veterinary Laboratory at Wallaceville. The history may be suggestive—namely, an outbreak following the introduction of fresh pigs, also the fact that somewhat older pigs and even sows may be attacked.

Treatment of affected pigs should be along lines suggested for suipestifer infection—isolation of affected, attention to comfort, and laxative feeding, no disturbing unnecessarily. The disease may occur under quite good conditions of management.

Necrotic dermatitis.—This involves ulcers, septic sores, &c., and is sometimes, though incorrectly, called "lupus." It is a repulsive condition and is all too common; it is the result of the infection of

small wounds by one or both of two organisms. One is the bacillus *Necrophorus*, a common contaminant of old yards, &c., and the cause of "foul-in-the-foot" in cows, black pox, calf diphtheria. The action of these, the first in particular, is to cause death of the surrounding tissue by the powerful toxins which they form, and thus there results a mass of dead tissue the extent of which constantly increases. While necrotic dermatitis is largely a dirt disease, commoner in old or filthy and contaminated yards, there seems little doubt that it may be set up occasionally in quite clean surroundings, and this chiefly by the introduction of already infected pigs. Direct contact with such a sore by any small wound on a healthy pig is liable to infect the latter, though by far the commonest way of infection is the contamination of wounds by mud and dirt containing the organism. Two factors are thus usually found to play a part in outbreaks: (1) Presence of the organism either in affected pigs, or, as usually seen, in dirty yards; (2) something leading to occurrence of small wounds, such as (*a*) excessive barbed wire in runs which is a fertile cause, and probably accounts for many cases about the face or shoulder; (*b*) overcrowding at feeding-time resulting in treads, &c., and probably responsible for many of the cases about the feet and pastern; (*c*) quarrelsome pigs biting their neighbours; (*d*) castration wounds; (*e*) teething—the four middle teeth come through the gum at the age of three to eight weeks, and this break in the gum is possibly the point of entry in some cases affecting the gums and lips of small pigs.

The symptoms are unmistakable. In some cases there is a small tumour-like swelling with a small wound, and, if open, this swelling is found to contain broken-down evil-smelling tissue, mingled with blood clots. In most cases there is a more or less extensive sore or ulcer, with raised edges but eating deeply into the underlying tissue; if scraped it is found to be lined with greyish toughly adherent tissue with a vile odour of decay. Such lesions may occur in any part as on the forehead extending into bone, around eye, inside the lip or eating away lower lip and interfering with feeding; on shoulder, side, or quarter; on knee, hock of pastern causing severe lameness; or in scrotum, as a result of infected castration wound—there they cause a large fibrous tumour with a necrotic centre and fistulous opening. Where feeding or locomotion is not interfered with, general health is unaffected.

Quite good results have frequently but not always been obtained from one or other of the following measures: (1) Isolation of all affected, again preferably by removing apparently healthy to clean quarters; (2) destruction of seriously lame or extensively affected; (3) thorough cleaning of sores, using good strong spray pump and any mild antiseptic solution (Condys), and scraping off scabs and dead tissue; (4) dressing with tincture of iodine and methylated spirits equal parts, bluestone solution, 4 oz. to a quart, hydrogen peroxide, or arsenical cattle-dip in 1–50 solution. The poisonous dressings should not be used about mouth. In case of scrotal swellings, these will sometimes recede if opened deeply and dressed with iodine.

Control is most important as the disease is largely preventable and is difficult to treat. It causes considerable economic loss—sometimes quite big pigs are attacked, and rendered useless for meat purposes, as many carcasses are condemned outright or partly, particularly

where the disease has attacked the scrotum. Barbed wire should be used as little as possible, at least for internal subdivisions. Overcrowding at feeding-places should be avoided. Pigs when castrated should be clean, and immediately after the operation should be moved and confined to thoroughly clean quarters for at least a fortnight, either a clean grass run or a scrupulously clean and bedded sty. Where such precautions are neglected, it is not uncommon to see every pig that has been castrated develop these lesions to some degree.

Mange.—This is an infectious disease due to the presence in the skin of a tiny almost microscopic mite. The female burrows in the skin to lay her eggs. An intense itch is set up. The disease has been mistaken for sunburn or for eczema of dietetic origin. The parasite will not live very long apart from the pig. As a rule, the disease has been seen following introduction of fresh pigs, but some outbreaks of it have developed through its presence in a sow in a mild and unrecognized chronic stage, over some considerable period.

The chief symptom is the intense itch, greater than that caused by lice. The disease commonly appears behind the ears, spreading along the back and sides, the skin shows minute red spots ; later a dry thick crust rises, and the skin itself becomes thickened and hairless ; the constant rubbing aggravates the lesion ; in young pigs growth stops ; condition is lost and some deaths may result of other diseases gaining a footing.

Thorough oiling with waste oil, or crude fuel oil, twice at intervals of a week, will cure most cases and a marked improvement in general condition frequently results. All contacts should also be treated, and where a considerable number of pigs is involved dipping is the most convenient method of treatment, the dip containing a layer of oil floating on water, or an antiseptic solution. Some breeders make a practice of dipping all purchased pigs, and believe that besides preventing the introduction of skin-parasites, it helps to protect against other infections. Suspected cases should be reported to the nearest Inspector of Stock, who will advise as to treatment. It is an offence to expose for sale pigs affected with this disease.

Lice and Fleas.—These cause considerable irritation, and if present in numbers must impair vitality. Lice are readily controlled by regular oiling, and the pigs may be allowed to carry this out themselves, if a rubbing post is provided, wrapped round wih sacking which is kept soaked with waste engine oil or whale oil. Fleas may be dealt with by a 1 to 4 mixture of kerosene and oil, but houses must be cleaned out and sprayed to get rid of the larval forms, and in sandy runs during the summer eradication of fleas may be very difficult.

Paralysis.—Trouble is sometimes experienced with pigs otherwise apparently healthy and often fat, which either stagger or sway about on hind feet, drop at the hocks, or are completely unable to support any weight with the hind limbs, which are trailed behind them. While sometimes seen in weaners, the condition is more often met in pigs about four months old, and occasionally in sows or boars. As pointed out by Seddon and Fraser, it is not a true paralysis, since there is still power of movement in the limbs. These writers also drew attention to a peculiar "falsetto squeal," characteristic of

affected pigs. The cause is not known definitely. Seddon and Fraser considered that it was not dietetic in origin. One is inclined to think, however, that it is related in some way to mineral metabolism, as some cases apparently show defects in the "mineralization" of the bones. A calcium deficiency might be suspected, but usually abundant milk is being fed, which should contain ample lime. There may, however, be failure to utilize this due to lack of vitamin D, which is largely removed from the milk in separating. Our experience has been that cases have been most frequent on peaty lands, and that skim-milk in abundance without supplement, has been fed. Investigation of this condition is in progress.

Treatment is very uncertain. Whilst in some cases a change of diet and the addition of lime, cod-liver oil, and iodine have been followed by recovery, in other cases these measures have failed. Attempts to prevent the condition have also been of doubtful value. The best advice one can offer is, where the trouble appears, to try the above variations in the diet, and where there is chance of more of the line becoming affected to quit them as porkers since the carcass is quite suitable for use.

The above disease should not be confused with a type of sudden lameness and soreness, with unwillingness to rise, sometimes seen in young pigs which squeal if handled, and which may show general symptoms of fever and illness not seen in "paralysis." This is a type of joint infection, and the hocks are sometimes visibly swollen. Death may follow after one or two days. Sudden chills and damp conditions are responsible for most cases.

Internal Parasites.—So far these are not of great importance here, but under the practice of using the same runs for pigs year after year ascarid infection, if once introduced, has every opportunity of becoming established and widely distributed. The ascaris is the common large white worm, the adult reaching to a foot in length, pointed at both ends. It is present in the small gut behind the stomach, but most damage is done by the larval forms which hatch from eggs after they are swallowed, and which bore through the tissues, chiefly lungs, setting up a form of pneumonia. Good sanitation, clean yards, and periodic changes of the runs on to clean country should keep this parasite in check.

The small red stomach-worm has occasionally been responsible for the deaths of mature pigs, principally sows. The lining of the stomach is found to be much thickened and roughened with many of the hair-line worms present.

Unthriftiness and deaths in young pigs has occasionally been found due to presence of large numbers, in the hydatid stage, of one of the tape-worms of the dog. These small bladders are found scattered through the belly cavity, and the liver is extensively damaged by their migrations through this organ. Their presence points to contamination of pigs' food—probably grazing—by dogs' excreta.

Tuberculosis.—While tuberculosis is the chief cause of condemnation of pig carcasses in meat-works, it is not usually given much thought by the pig-farmer, as clinical signs are rarely shown by affected pigs. Swelling of the glands at the throat, or, in sows, a chronic cough, or a chronic enlargement of one or more sections of mammary gland or

an unthriftiness should be regarded as suspicious. While one has seen an infected sow with a litter showing clinical signs of the disease, apparently contracted from the mother, most cases are due to the milk of infected cows, and any undue number of condemnations in farm pigs should call for careful scrutiny of the dairy herd. However, until efficient and universal pasteurization of all dairy by-products fed to pigs is adopted, or elimination of tuberculosis from dairy herds is brought about universal use of the tuberculin test, condemnations of pig carcasses for tuberculosis are not likely to diminish.

It may be noticed that in the United States of America a proportion of tuberculosis in pigs has been found to be due to the avian type of organism, infection being from poultry. This has not so far been found in pigs in New Zealand, though tuberculosis in poultry is common.

THE CLEANING OF MILKING-MACHINES.

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The cleaning of milking-machines by what is now commonly termed "the boiling-water and caustic-soda method" has been extensively practised for a number of years, and has stood the test of time. No other known method has proved so satisfactory with respect to sanitary efficiency combined with simplicity, speed, and cheapness in operation.

THE LAYOUT OF THE MILKING-MACHINE.

The more compact the layout of the machine the greater the ease in cleaning. Various types of machines are in use, and of these "the releaser and vacuum-tank" type is the most common. A few comments about the layout of this type of machine will serve to indicate how the method of cleaning can be usually applied to the best advantage.

The main milk-pipe running through the shed should not be placed higher than is really necessary, and if possible should lead directly into the releaser without elevation. It should be well supported by brackets at distances close enough to prevent sagging and have a fall towards the releaser of at least 1 in. to each 7 ft. of length. The main vacuum pipe should have a similar fall towards the vacuum tank, as should the breather pipe from the pulsator to the releaser. The pulsation or air-pipes should be so installed as to have a fall towards the screwed end. Piping installed in this manner is easily accessible for cleaning, and effective draining is ensured.

THE RUBBERWARE PARTS.

Rubberware of first-grade quality is the best and cheapest to use. Tubing and inflations, when new, possess a very smooth inside surface, and this condition can be maintained for a long period, provided the method of cleaning is properly carried out. Spiral brushes or metal scrapers should not be used for cleaning the inner surface of rubber tubing, as they cause scoring and roughening

of the surface, and create lodging-places for deposits of milk and germs, with disastrous results both to the rubber and the quality of the milk.

The accompanying illustrations emphasize the comparative effects on the rubbers, and demonstrate the good results obtainable by using the boiling-water and caustic-soda method of cleaning.

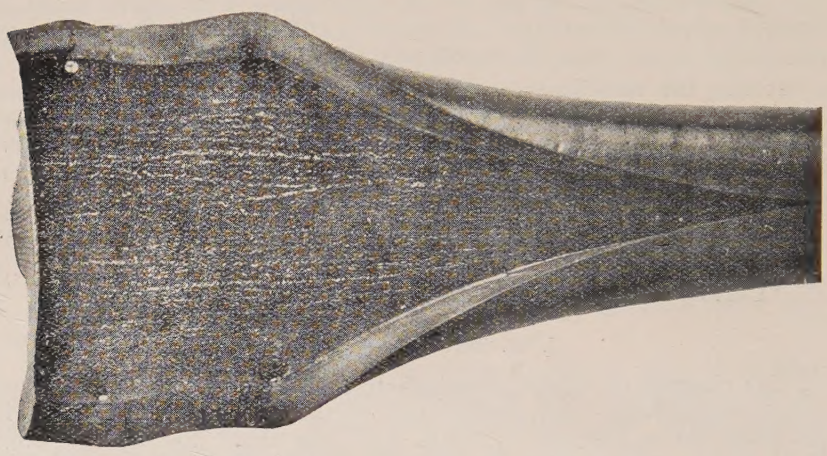

FIG. 1. LONG MILK-RUBBER AFTER TWELVE MONTHS' USE AND CLEANING DAILY WITH BOILING WATER, WASHING-SODA, AND THE USE OF A BRUSH AND SCRAPER. NOTE THE SCORED INNER SURFACE OF THE TUBE.

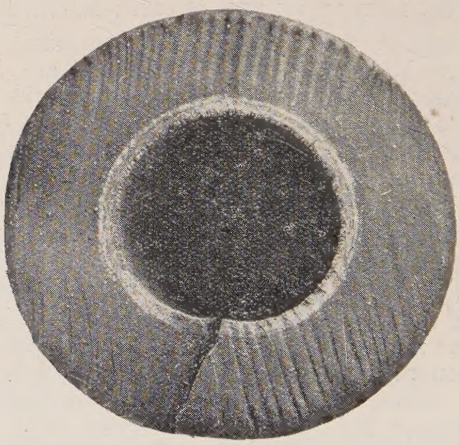

FIG. 2. END VIEW OF THE SAME RUBBER (FIG. 1). THE WHITISH INNER CIRCLE INDICATES THE SCORED SURFACE OF THE TUBE.

THE MATERIALS AND APPLIANCES REQUIRED.

The principal requirements are :—

(1) An adequate clean cold-water supply.

(2) Suitable means for providing sufficient boiling water for the cleaning of the machine after each use, such as a copper, steam-boiler, or an efficient electric heater.

(3) A metal bath or tub of suitable size, some large buckets, scrubbing-brushes, a ball of horse-hair or a small pipe-traveller hair brush, and an ample supply of caustic soda.

(4) A dairy thermometer registering to 212° F. or a few degrees over.

For cleaning cans, separator parts, &c., a supply of washing-soda should be provided.

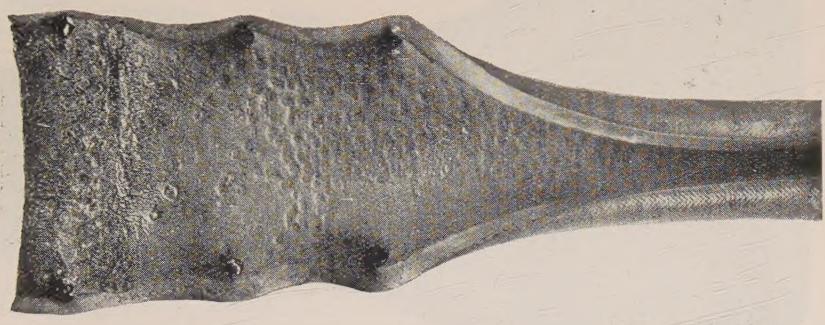

FIG. 3. CLAW-TUBE RUBBER FROM THE SAME MACHINE AS MILK-TUBE IN FIGS. 1 AND 2. THE INDENTATIONS INDICATE EFFECT OF LODGMENT OF GREASE.

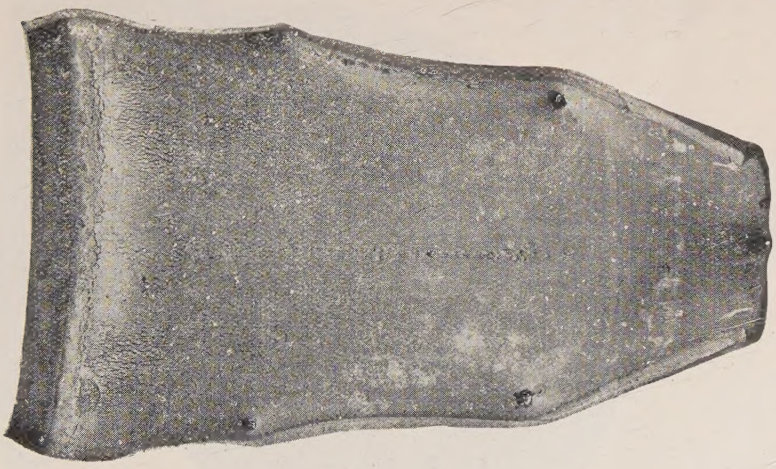

FIG. 4. ORDINARY TEAT-CUP SOFT INFLATION AFTER THREE MONTHS' USE, SHOWING THE EFFECTS OF BRUSHING.

Strength of the Boiling-water Caustic-soda Solution.

The correct strength of the solution to use is one full teaspoon of caustic soda to each four gallons of boiling water. If this strength is adhered to, and its use immediately followed by rinsing out with at least double the quantity of clean boiling water, no harm will come to the rubber or other parts of the plant.

Application of the Boiling-water and Caustic-soda Method.

The procedure is as follows :—

(1) After starting the machine, and before commencing to milk, draw some clean cold water through each set of teat-cups, taking care that the water does not run into the milk vat or cans. This rinsing with cold water prevents adhesion of milk to the piping.

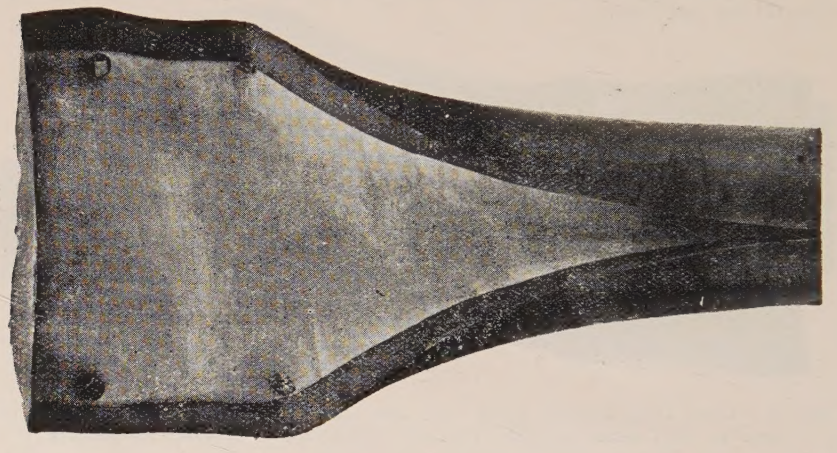

FIG. 5. LONG MILK-RUBBER AFTER TWO SEASONS' USE AND CLEANING DAILY BY THE BOILING-WATER AND CAUSTIC-SODA METHOD.

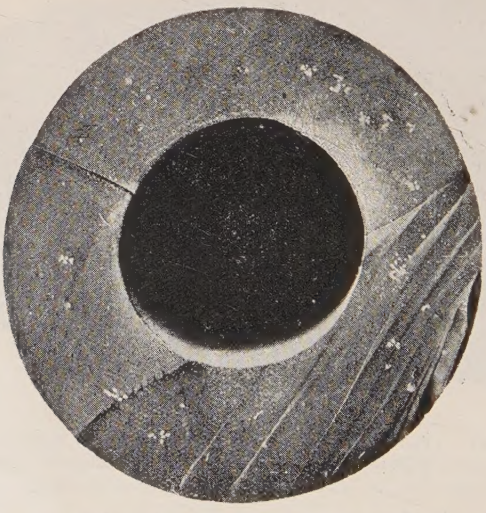

FIG. 6. END VIEW OF THE SAME RUBBER (FIG. 5).

(2) Immediately after milking and before applying the boiling caustic-soda solution, draw some cold water through each set of teat-cups, in order to rinse out any milk remaining in the system. Failure to use cold water before the application of the boiling caustic-soda solution will result in the gradual formation in the milk-passages of a hard scale, commonly called "milkstone."

(3) Wash off all dirt from the outsides of the teat-cups and rubber tubing with a solution of warm water and caustic soda, and well rinse with hot water.

(4) Put the releaser out of milking action by stopping the pulsator at a point that will cause the outside flap of the releaser to seat tight. Then draw through each separate set of teat-cups at least one gallon of the boiling caustic-soda solution. On drawing it

FIG. 7. CLAW-TUBE RUBBER FROM THE SAME MACHINE AS MILK-TUBE IN FIG 5.

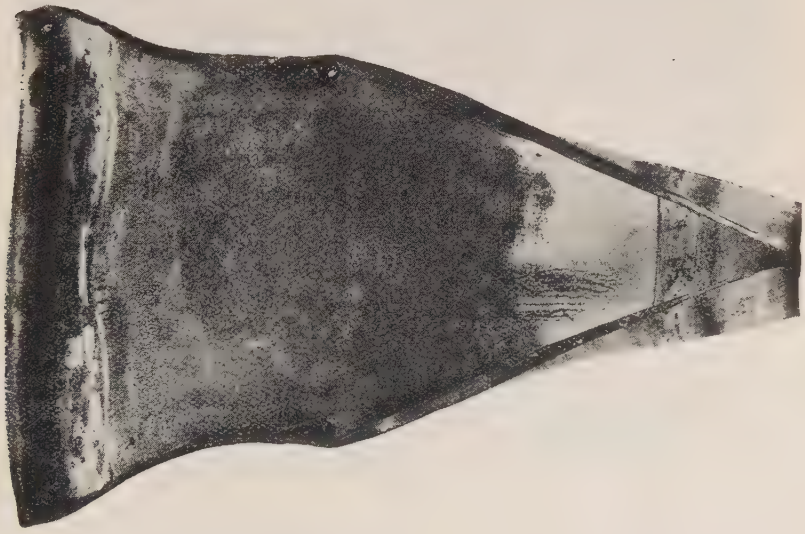

FIG. 8. ORDINARY TEAT-CUP SOFT INFLATION AFTER FOUR MONTHS' USE AND CLEANING BY THE BOILING-WATER AND CAUSTIC-SODA METHOD.

through the set farthest from the releaser, carefully lift the flap or plug of the end of the main milk-pipe and insert a 6 in. length of plaited horse-hair or the pipe-traveller brush, retaining hold of same until the vacuum pressure again rises, and simultaneously remove the plug for a moment and allow the horse-hair or brush to whisk into the releaser. The releaser becomes full, and the overflow travels into the vacuum-tank. Next, place an empty bucket

under the releaser, break the vacuum by removing the plug from the end of the milk-pipe, and the contents of the releaser discharge into the bucket. Then replace the pipe-plug.

(5) To remove all traces of the soda solution, immediately draw through each set of teat-cups at least two gallons of clean boiling water. Both the soda solution and boiling water are applied with the best results by dousing the cups in and out of the liquid, about three quarters of the time in and one-quarter of the time out. The resultant inrush of air quickens the flow of the liquid, and causes it to surge with a scouring action through the piping. The quantities of the boiling liquids should be sufficient to fill the system and overflow the releaser by,

FIG. 9. A GROOVED HARD TEAT-CUP INFLATION AFTER TWELVE MONTHS' USE AND CLEANING BY THE SAME METHOD. CAPABLE OF THREE MONTHS' FURTHER USE.

at least, one gallon, thus cleaning the pipe between the releaser and vacuum tank. In addition, as a result of stopping the pulsator, the hot water is retained in the system, which thereby is heated to a maximum heating temperature. The vacuum and air system should next be cleaned.

(6) Detach the air rubber tubing from each claw and place the ends in boiling caustic-soda solution, and draw up at least a quart through each, then rinse with clean boiling water. The water will pass through the tubing under the pulsator-slide and into the main vacuum pipe and into the vacuum tank.

(7) Next detach the air-pipe from the rubber tube connecting it to the outer chamber of the releaser, and draw through about a quart or more of the boiling soda solution, and then some clean boiling water. These fluids will also travel to the vacuum tank. The cleaning to this stage is as much as need be done under vacuum.

(8) Before stopping the machine, allow the teat-cups and all air-pipes to draw air for a few moments. Remove and replace the plug on the main milk-pipe two or three times to cause an inrush of air to carry away all surface moisture and to leave the machine dry and sweet.

(9) Leave all taps and ends open to allow of the free circulation of air, then stop the machine.

(10) Next scrub and scald the vacuum tank.

(11) Dismantle the releaser and scrub and scald it.

(12) Disconnect the teat-cups and rubbers from the milk and air pipes and place them in a dry airy clean place protected from dust and the rays of the sun.

It is essential that the temperature of the hot water used be not less than 200° F. and preferably boiling—*i.e.*, 212° F. A thermometer should be used to check the temperature. Too little boiling water is often used, but rarely too much.

To produce milk of good hygienic quality, milking-machines should be regularly cleaned as outlined each time after use. With practice, the average machine can be cleaned in about twenty minutes.

MILKSTONE.

If a milking-machine is not regularly flushed with cold water to remove all traces of milk prior to treating with hot cleaning solution or steam, a hard deposit readily forms inside the pipes. This "milkstone," as it is called, enables germs to multiply, and special steps must be taken to get rid of it. The simplest method is to use a weak solution of spirits of salts (hydrochloric acid), promptly followed by liberal rinsing with hot-water soda solution. The procedure is to dismantle the piping and prepare a solution of spirits of salts in the proportion of one part of spirits to three of water. In some cases a stronger solution may be required. To each 7 ft. length of piping use 8 oz., or about a breakfastcupful. Plug one end of the pipe, pour in the solution, then plug the other end. Allow the solution to remain in the pipe for about thirty minutes, revolving the pipe occasionally to ensure distribution of the solution so as to soften the scale. Remove the plugs and clean the pipe with hot washing-soda solution and a tight-fitting hard brush; then rinse with clean boiling water. This treatment, properly applied, will leave the surface clean and bright.

Figs. Nos. 10 and 11 are illustrations of half-sections of a length of pipe before and after treatment by this method.

STEAM STERILIZATION OF MILKING-MACHINES AND DAIRY UTENSILS.

The "boiling-water and caustic-soda method" of cleaning, properly applied, leaves the milking-machine in a satisfactory sanitary condition. A further improvement is still possible by

FIG. 10. HALF-SECTION OF MAIN MILK-PIPE AFFECTED WITH MILKSTONE.

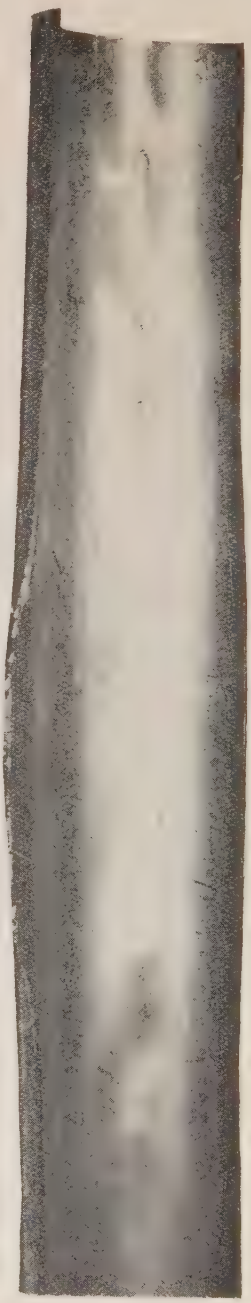

FIG 11. HALF-SECTION OF SIMILAR PIPE AFTER TREATMENT.

afterwards subjecting the inside parts of the machine to low-pressure steam for about five minutes to effect sterilization.

Steaming alone will do harm rather than good, since, if the machine and utensils are not first thoroughly cleaned to remove all traces of milk, the application of steam (or even boiling water) not preceded by flushing with cold water will have the effect of causing hard deposits of milkstone to form in the machine. Such deposits accumulate from day to day and harbour countless millions of bacteria which resist prolonged efforts to destroy them. It should not be thought that the use of steam alone provides a short-cut to cleaning a machine. Proper cleaning with cold water, boiling caustic-soda solution, and boiling water should be carried out before steaming. Sterilization with steam provides the finishing touch, and is the best possible safeguard for quality.

For sterilizing dairy utensils steam may be generated in a small pressure boiler, which can also be used to provide ample hot water. Such pressure boilers have the advantage of possessing ample reserve of pressure to force the steam to the farthest end of the milking-machine pipes. During the last few years a variety of heating plants have been designed to provide readily an ample supply of both boiling water and steam by burning rapidly wood, coal, &c.

Even when machines are in the best sanitary condition, the milk may be seriously contaminated through coming into contact with other equipment, coolers, cans, &c., which, although well washed, have not been sterilized. Consequently, these should also be thoroughly steamed. Cans are treated most effectively by inverting them over a steam jet. The cooler may prove difficult to sterilize unless it is of such a size that it can be placed inside a suitable can or tank. After detaching from the water-supply to wash it thoroughly, the cooler can be sterilized by connecting a steam-hose to where the water runs in. In cases where a small tank is used as a steam-chest, care must be taken that steam is turned on long enough to ensure the whole contents being adequately treated. To ascertain this, a thermometer should be inserted as near as possible to the bottom of the tank, on the opposite end from the steam inlet, and the flow of steam should be kept up for five minutes at least after 210° F. is registered.

The Use of Disinfecting-compounds.

It is many years since the first attempts were made to minimize contamination of the milk by washing cows' udders with coal-tar disinfectants and similar carbolic fluids or with solutions of chloride of lime. Traces of these disinfectants inevitably reached the milk and produced off-flavours.

A satisfactory material for use upon udders is a dilute solution of Condy's crystals (permanganate of potash), which has no odour. Sufficient should be used to colour the water a deep pink (avoid making it a dark red), and when the pink disappears it is time to obtain clean water and use more crystals.

In recent years the desire to improve the cleanliness of milking-machines has provided the opportunity for persuading farmers to

use various chemical disinfectants, particularly those having a chlorine basis, such as bleaching-powder or chloride of lime, hypochlorites, &c. It has been noticed repeatedly that whenever these compounds are used in connection with the cleaning of milking-machines, cans, &c., excessive amounts inevitably find their way into the milk and cream. Cases have been observed where suppliers were getting the highest grade regularly for their milk or cream and suddenly changed to second grade. Upon investigation it was found that some chemical sterilizing-solution had been used. When the use of this was discontinued, the grade returned to the previous high standard. Metals, especially in parts of a milking-machine, are very readily corroded by strong chlorine solutions. The use of these compounds for the cleaning or sterilization of milking-machines, cans, &c., should be avoided.

THE MISUSE OF LIME, WITH SPECIAL REFERENCE TO BUSH-SICK LANDS.

B. C. Aston, Chief Chemist, Department of Agriculture.

(Concluded.)

In a report from Mr. C. R. Taylor on the Whakamarama district, 7th February, 1934, he states: " . . . In quite a number of instances evidence was not lacking to show that lime had reacted to the user's detriment, although one farmer thought that its moderate use had improved his pastures and made them more palatable to stock." Another settler at Tauranga a few years ago lost a number of stock after top-dressing with lime where previously he had carried them successfully.

In other countries experimenters have recorded the injurious effects of lime on sandy or light soil. Liechti and Truninger, *International Review of Agriculture*, 1927, page 429, determined the effect of carbonate of lime on sandy loam and loamy sand soils with results as follows (control equals 100): Oats, 80–94; clover, 76–93; lucerne, 75–91; potatoes, 79·7–93·7; spring barley, 90·7; beet, 55. The authors conclude that liming is unsuitable for sandy soils.

Lipman, Blair, and Prince, *International Review of Agriculture*, 1926, page 546, state: "The effect of liming on the potash content of the soil and corn-stalks was determined. The lime was used in conjunction with twenty different fertilizer treatments including green manures and potash salts, with the following average results:—

Percentage of potash in—	Limed.	Unlimed.
Soils	1·088	1·364
Subsoils	1·233	1·417
Corn-stalks	1·972	2·343
Potash in corn-stalks in pounds per acre	67·16	63·54 "

All the individual figures showed the same trend.

Sir John Russell, *Journal of Royal Agricultural Society of England*, 1919, page 95, on the reclamation of waste land, states: "The

conditions of a light sandy soil tend to shorten the life of the plant . . . Lime is needed but the low quantity of organic matter is a warning that great care must be exercised, otherwise loss is the result."

Liechti and Truninger, *International Review of Agriculture*, 1921, page 315, in pot experiments with a sandy clay soil poor in lime, using flax as the experimental plant, found that lime had a retarding effect on flowering in proportion to the amount used, and the largest amount of lime prevented fructification and induced apical necrosis.

Gile and Carrero, *Journal of Agricultural Research*, 1920, Vol. 20, page 33, dealing with lime-induced chlorosis in plants state that all calcareous soils do not induce chlorosis, and the authors believe it is not calcium carbonate itself that causes chlorosis, but some condition associated with the presence of carbonate of lime. The weight of evidence points to a deficiency of iron in the ash as being one cause of the chlorosis, with possibly an excess of lime as a contributory cause. Work in water cultures with rice seems to show definitely that the alkalinity of carbonate of lime is not directly injurious to this calcifugous plant, nor is the alkalinity in itself a cause of chlorosis.

De Angelis d'Ossat, *International Review of Agriculture*, 1921, page 156, dealing with the action of iron and manganese in soils and plants and chlorosis caused by excess of manganese, suggests that the iron manganese balance rather than their presence or availability is what is disturbed by excess of lime.

Shaw, *Experiment Station Record*, 1932, Vol. 67, page 250, records that on a sandy loam soil liming actually decreased the growth of apple-trees, except where potash was also applied.

Tacke, *Experiment Station Record*, 1914, Vol. 31, page 726, says that excessive liming on moor and sandy soils has an unfavourable effect, and on such soils poor in lime liming has a very lasting effect, and should only be done when the necessity for it is indicated by comparative tests.

Hall and Russell, "*Agriculture and Soils of Kent, Surrey, and Sussex*," referring to the Bagshot sands say: ". . . The soil has remained heath and common simply because it has always been too poor to be worth enclosing and cultivating. Only near the bottoms of the valleys or on certain areas where the soil is not so light as usual has cultivation sprung up, but thanks to the liberal use of London dung, street refuse, and the like, the barren sands have in many cases been transformed into useful land especially for market-garden purposes. The soil is entirely sand and is entirely lacking in lime, the carbonate of lime figures ranging from nil (two soils), 0·01 (three soils), 0·27 (one soil), and 0·4 (one soil). Manuring has so far been confined to dung, but the authors recommend chalk or lime in the early spring before the land is broken up, and also neutral phosphates (guano or bone-flour) and sulphate of potash, and sodium nitrate. Manuring should only just precede sowing. Where land is regularly hayed 1 ton lime and 10 to 15 tons farmyard manure every five years. Sandy soils are only used for hops when well supplied with ground water and large quantities of dung can be applied. The hop plant has no special need for lime. On heavy calcareous soils all fruit-trees seem to suffer and are liable to become chlorotic. On the light sandy formations the soil is too open

and too devoid of carbonate of lime to be worth cultivating. It must be chalked and clayed, and even then is of little value in exposed places. These soils are rarely found in cultivation, except where great quantities of stable manure are available. The wash from the Bagshot beds responds in a marked degree to lime in some places (Weybridge, Surrey), but at others it requires considerable dressings of dung."

It will be noted that these soils are mainly for cropping for market-garden purposes, and not for the pasturage of stock. Liming is only permissible when added with large quantities of farmyard manure or London dung or clay. For an account of the injurious effect of carbonate of lime in large quantities, see "Soil Conditions and Plant Growth," 1932, page 122, by Sir John Russell.

Gile, Porto Rico Agricultural Experiment Station Bull. 11, 1911, records that pineapple chlorosis occurs on soils containing much carbonate of lime, while soils on which plants recovered contained little lime and no carbonate of lime.

Hendrick and Ogg record in *Journal of Agricultural Science*, Vol. 7, 1916, page 458, that Scottish drift soil at Craibstone was of a coarse sandy nature with less than 5 per cent. of clay, but comparatively rich in organic matter and total and available phosphate and potash. It had a high lime requirement and contained no lime, but had grown good crops for many years without the application of lime.

Robinson and Rice-Williams, Faraday Society, 1924, page 593, state: ". . . From studies of Welsh soils containing small quantities of clay and large amounts of organic matter, it appears that unsaturation—that is, the presence of free aluminosilicic and humic acids—is not inconsistent with fertility, and that many soils in this condition do not respond to lime."

W. M. Davies, *Journal of Royal Agricultural Society of England*, 1932, page 21, states that on sandy soils with high humus content, liming may give rise to "grey spot" in oats which is due to inability of the plant to obtain sufficient manganese. Solid sulphate of manganese ($MnSO_4$) and basic slag proved the most effective cures. Solutions of iron salts had no effect. Iron chlorosis is also referred to and the statement made that heavy liming tends to favour attack by some fungous diseases—*e.g.*, potato scab. On the other hand, liming of course mitigates clubroot.

An English official publication "Research and the Land," Wilkins, 1927, Ministry of Agriculture and Fisheries, London, in a most interesting chapter on soil sourness, mentions the fact that many soils in Scotland, North Wales, and Ulster rich in exchangeable bases show little lime starvation though so deficient in calcium. The little-weathered Scottish soils with their great reserves of basic plant-foods can be frequently manured with ammonium sulphate with no risk of inducing acidity, and the soils rarely show extreme lime hunger as English soils do when treated with frequent applications of ammonium sulphate. The case of North Ireland is very similar. In that country numerous soil-samples have been examined in connection with field-experiment trials, and in only one case did the soil contain calcium carbonate; thus the area is largely devoid of lime in the ordinary sense of the word, but there is not a lime shortage as we understood, for the soils

are richly supplied with other bases and the preliminary liming experiments that have been carried out in the area show, so far, no marked beneficial results from liming. The same thing applies to North Wales, where many of the most fertile soils contain no calcium carbonate and the application of lime has no effect on the crop, even though the soils show much lime hunger by recognized methods of testing.

The coarse pumice soils of the North Island volcanic plateau of New Zealand are also composed of particles which have not been weathered down to the extent found in ordinary fertile soils, and thus are similar in their lack of response to lime to the soils of Scotland, Wales, and Ireland mentioned above. The particles of the pumice soils are composed of a volcanic froth, in most cases deposited by air-currents. The soil therefore, from the manner of its deposition from air, is extraordinarily light. A cubic foot of moist soil may weigh only 68 lb., whereas the better-class and more weathered soils of the district which are free from bush sickness may weigh 86 lb. Although sandy in texture the pumice soils are composed of silicates of the metals rather than a pure silica (quartz), and contain large reserves of metals, particularly potassium, sodium, calcium, magnesium, and aluminium, which are combined with silica, and only become weathered or oxidized and available to plants extremely slowly. Owing to the iron and manganese having been largely leached out, the soils are light in colour. A recent report from Mr. C. R. Taylor, Analyst's Assistant at Rotorua, states that from inquiries he has made he finds that lime alone applied as a top-dressing for pumice soils produces a pasture more unpalatable and drier in appearance than that on the (untreated) control plot, while, generally speaking, lime and superphosphate mixture give an inferior result to that from superphosphate applied alone. Smallfield ("Pasture Establishment on Pumice Lands," this *Journal*, December, 1933, page 354) states: "Pumice land shows a marked response to phosphatic and nitrogenous fertilizers, potash and lime give little or no visible response."

Danger in Licks.

In addition to the danger of applying lime (burnt or unburnt) to pastures on bush-sick soils, in the giving of mineral foods to stock with salt as a lick it is inadvisable to use lime in either of those forms, and this is a warning which is applicable to farms both in and outside the bush-sick area. The difficulty of controlling the amount of lick which any one animal may take from a lick-box makes it difficult to prevent overdosage of any one ingredient.

Charles Crowther in "The Feeding of Live-stock" (*Jour. Roy. Ag. Soc., England*, 1933, Vol. 94, pp. 268–309) states:—

"From recent work at the Rowett Institute (J. P. McGowan, *Bioch. Journal*, Vol. 27, p. 934) it would appear that the most important single factor controlling the absorption of calcium and phosphorus is the acidity of the gastric juices. An excess of calcium in the diet, by neutralizing the hydrochloric acid of the juice, precipitates the phosphorus as tricalcic phosphate, whereby the assimilation of phosphorus is lowered. In view of the rather indiscriminate use of lime in various forms in present-day feeding practice, this observation is distinctly interesting, and finds support

in the evidence from practical feeding experiments that the supply of lime in rations beyond a certain proportion, which is quite low, may be definitely injurious."

The practical application of this work to New Zealand conditions where the control of lick to stock is very much more difficult than it is in England is that extreme care should be exercised in adding any alkaline compound to licks intended for automatical ingestion by the animal from troughs or lick receptacles in paddock, hillside, or dairy-shed. For some time past the writer has endeavoured to press this view on those whose business it is to manufacture licks for the farmer or to the farmer who makes up his own materials. It is now repeated that it is undesirable to include quicklime, slaked lime, carbonate of lime, carbonate of soda, or any alkaline material in the manufacture of stock-licks intended for ruminants.

The subject of the administration of mineral foods to domestic stock pastured on the great grazing countries is a most interesting one, opening up a wide field for investigation and discussion. In the drier countries of the world where it is not practicable to top-dress pastures, the giving of calcium phosphate licks has been systematized for many years; but in New Zealand, although rock-salt and agricultural salt has been used extensively, the giving of compound licks containing such minerals as phosphates, iron salts, iodine salts, calcium, and magnesic salts is a development of comparatively recent date.

In the early days of the bush-sickness investigation, over twenty years ago, many long-continued experiments, extending over many months and even years, were carried out to decide the best method of giving mineral foods thought to be deficient in the pasture and soil. Some of the results were so hopeful and the animals after a year's treatment appeared so healthy and normal in their growth and development that one might have been pardoned for supposing that the problem of a cure for bush-sickness had been solved. A further year's trials carried on and supplemented by additional experimental animals proved that no permanent cure could be effected in the particular manner which appeared so hopeful after twelve months' work. These experiments were an endeavour to keep stock healthy by giving superphosphate (monocalcium phosphate) in the drinking-water while the animal was confined to a pasture which had never been top-dressed with phosphate or any other fertilizer except that incidental to the natural grazing of stock on the paddock, which was a surface-sown pasture still in stumps. These results, which had aroused the highest hopes of the veterinarians and chemists in charge, dealt with a steer and a heifer and subsequently with calves. Although no permanent cure could be effected in this way, the experiments proved valuable in showing that by this simple and cheap way certain stock could be kept in health on sick pasture, the steer becoming fit for the butcher in a period which may have been impossible without medicated drinking-water. Probably, however, the most important lesson learned was that experiments with minerals on stock may give beneficial results for many months and yet prove to be illusive in effecting a cure in the end.

The preliminary good result may have been due to an unnatural stimulation of the cattle by repeated small doses of a mineral stimulant such as arsenic which was found to be present in the superphosphate to the extent of not more than 0·05 per cent., or it may have been due merely to the absorption of one of the other main constituents, phosphorus, calcium, or sulphur, instead of the minor impurity, arsenic. In an experiment in which the ruminants, sheep and heifer, were daily dosed with a copper solution the same wonderful stimulation was found to result, although this was not conducted on bush-sick country, but on healthy country where they had the usual supply of good pasture; and yet after more than a year of dosing these animals fell away in condition and some even died.

Other compounds are sometimes added to licks which, instead of injuring by deranging the animal's digestive functions, quickly kill it by acute poisoning. Twenty years ago a lick was put on the market which contained arsenic, a substance that in moderation is a great animal stimulant, and one which apparently enables animals to assimilate iron in forms such as the sulphate or chloride. (Those administered alone had been proved by lengthy experiments to be neither a preventive nor a cure for bush-sickness.) In this case with arsenic striking cures of mature cattle in the last stages of bush sickness were certified to by a committee of farmers, while the same committee found it ineffective on young stock. Certainly an official test killed a cattle beast which had free access to the arsenic-iron lick. This is an extreme case, but it shows the necessity for caution in the making of lick for stock under the conditions where the dosage per animal cannot be strictly controlled.

Summary.

Evidence is submitted to show that there is a danger in liming pastures on sandy soils, and that not only is the money so spent wasted, but that positive injury may result to the stock.

In the making of stock licks alkaline compounds such as lime or soda should not be used. Poisonous mineral stimulants such as arsenic should not be intentionally added. Commercial chemicals used in making licks may contain arsenic as an impurity in such small quantities that it may be useful.

The Instructor in Agriculture at Whangarei reports: "Certified perennial rye and certified white clover have been established successively by surface cultivation on rough country, swamp land, on the farm of Mr. P. Hill, Dargaville. The areas dealt with during the past three years include about 25 acres of old paspalum pasture on rough hummocky swamp land, now well drained. A paddock of from 6 acres to 8 acres was taken in hand at a time. The lumps and hillocks were cut open with a double cut of the disks in September and October, and broke quite well in the summer. The disks were again used in late February and March to further cultivate the surface, and with a stroke or two of the harrows a good seed bed was acquired much earlier than was possible when the cultivation was left until the autumn. Ten pounds of certified perennial rye and from 1 lb. to 2 lb. of white clover sown at the end of March with the top-dressing has given a good strike, and the sward in each paddock is now showing a good proportion of rye and white clover, while the mower can be used quite easily."

STRAIN INVESTIGATION IN WHITE CLOVER.

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PLOT trials of white clover in conjunction with type-testing for certification purposes have been continued at the Plant Research Station since the last report contained in this *Journal* for February, 1933, and some two thousand lines have now been subjected to trial. A part of this mass of material has now been finally analysed for type, and shows the following position in relation to certification (Table 1):—

Table 1.—Showing Analysis of New Zealand White Clover Lots relative to Certification.

Number of Lines finalized.	Number up to Mother Seed Standard.	Number up to Permanent Pasture Standard.	Number rejected for Certification.
997	126	378	493

The number of New Zealand lines rejected for certification is very large owing to the high standard set for New Zealand certified seeds. Most of New Zealand ordinary white clover which is not included in certification is of a relatively high standard compared with white clover of European origin, and its exclusion from certification come about through accepting only the very best types for certification purposes.

In the course of plot-testing for type, excellent opportunities are given for testing lines of authentic origin and for comparing the relative merits of one type against another. In the spring of 1932, 368 lines were sown, and yield weights of representative types of green herbage have been taken up to the present time. These yields are set out in Table 2.

Table 2.—Showing Production in Terms of Green Weights, and relative One Type to Another, of White Clover as Pure Swards, sown 19th September, 1932.

(Green weight in pounds per acre.)

	Number of Plots.	Summer Growth.	Winter Growth.	Spring and Summer Growth.	Late Autumn Growth.
		lb.	lb.	lb.	lb.
Station selection, Ac 2070 ..	3	18,600	5,350	39,300	5,110
New Zealand No. 1 ..	16	14,500	2,520	38,934	3,500
New Zealand No. 2 ..	28	12,050	1,620	31,126	1,040
Ordinary New Zealand ..	12	8,380	950	27,024	740
Kentish Wild White ..	7	6,790	662	25,420	510
Kentish once-grown in New Zealand	2	7,260	618	25,840	925
New Zealand Dutch ..	6	5,250	470	16,110	100
Imported Dutch	3	6,090	510	15,214	Nil
Morso	3	9,880	432	21,354	1,332
Ladino	2	13,920	3,742	24,284	1,020
Australian	5	6,759	790	27,679	333

Above Weights relative to New Zealand No. 1 (=100) at each Period.

—	Summer Growth.	Winter Growth.	Spring and Summer Growth.	Late Autumn Growth.
Station selection, Ac 2070	128	211	101	147
New Zealand No. 1	100	100	100	100
New Zealand No. 2	83	64	80	29
Ordinary New Zealand	57	37	69	21
Kentish Wild White	47	26	65	15
Kentish once-grown in New Zealand ..	50	24	66	27
New Zealand Dutch	36	19	41	3
Imported Dutch	42	20	39	0
Morso	68	17	55	38
Ladino	96	147	62	29
Australian	47	32	71	10

These plots are very carefully sown, and all volunteer white is controlled so that the performance as measured is due entirely to the seed sown. These trials have not been conducted under grazing, and in this respect the results may be open to some criticism by the practical man. The great variation in yield as secured in these trials may not be secured in ordinary field practice where volunteer white is prevalent, and this is particularly true where the volunteer white is of a good or comparatively good type. Thus, if a New Zealand certified permanent pasture white clover were sown down in certain parts of Hawke's Bay or North Canterbury where the New Zealand No. 1 ecotype naturally predominates, there is every likelihood that the volunteer New Zealand No. 1 ecotype would take charge as far as the white clover population was concerned, owing to its more aggressive nature than the sown certified permanent pasture type, and this is true irrespective of what type of white clover were sown, unless it were a better New Zealand No. 1 type or a selected line of greater vigour than the volunteer white. Many farmers in New Zealand maintain that it does not pay to sow white clover because of its appearance in the sward from volunteer seed lying dormant in the ground. This, in a measure, is true, and whether the action is justified depends upon what type of white clover volunteers. It can be said that on reasonably fertile, highly productive country there is a probability that the volunteer white is infinitely better than certain uncertified, open market white clover, and this would certainly be true if the open market seed were of European origin. Certification of the best types of white clover, and this will be particularly true when certified pedigree seed becomes available, puts an entirely different aspect on the matter, and, whereas the volunteer of the farm may have been better than open market seed, it can be taken in nine cases out of ten that certified seeds will give better results than will the volunteer of the farm.

In reviewing the results of the green weights of the various types as set out in Table 2, it is desired to stress two important differences: (1) The total green weight of the New Zealand No. 1= certified mother seed class, and the Station selection from this type compared with all other types of white clover; (2) the long seasonal

growth range of the New Zealand No. 1 and selections ex this type. In the section of Table 2 giving relative weights, it will be seen that in the winter growth period—a critical time in pasture production—the New Zealand No. 1 was yielding from three to five times as much as the ordinary and imported strains, and the selections ex New Zealand No. 1 were in certain cases giving upwards of ten times the yield of clover at this date. If the period for late autumn is taken, a period when white clover tends rapidly to disappear as a pasture producer, the New Zealand No. 1 is again outstandingly ahead of the ordinary strains, and the Station selections ex New Zealand No. 1 type are again ahead of

FIG. 1. SOME WHITE CLOVER PLOTS IN THE SECOND YEAR OF TRIAL PHOTOGRAPHED 18TH MARCH, 1934, AND SHOWING SOME OUTSTANDING TYPE DIFFERENCES.

In the foreground and mid-foreground New Zealand No. 1 type is contrasted with ordinary New Zealand rejected for certification. The run of plots in third traverse are all Station single-plant selections ex New Zealand No. 1 type. [*Photo, E. Bruce Levy.*

the New Zealand No. 1; and whereas with ordinary white clover a six months' growing period may be regarded as satisfactory, with a New Zealand No. 1 and its selections some growth of white clover under reasonable treatment may be expected, in the North Island at least, for almost the twelve months of the year. This long seasonal range of growth is of very great value for two important reasons: (1) Phosphatic manures may be applied almost at any time of the year with the assurance that there will be no leakages as a result of the manure being applied and becoming

FIG. 2. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES. NEW ZEALAND NO. 1 (SELECTION), TWO PLOTS ON RIGHT; NEW ZEALAND DUTCH TYPE ON LEFT.

Note the marked earlier and prolific flowering of the latter type. Photographed 31st January, 1933, when plots were four months old. Compare with fig. 3.

FIG. 3. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES. NEW ZEALAND NO. 1 (SELECTION), TWO PLOTS ON RIGHT; NEW ZEALAND DUTCH TYPES ON LEFT.

Same plots as shown in fig. 2, but photographed, 9th August, 1933. The New Zealand Dutch types are rapidly running out and are being replaced by sorrel.

[*Photos, E. Bruce Levy.*

FIG. 4. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES WITH KENTISH WILD WHITE AND MORSO.

Three plots mid-centre, left to right—(1) Kentish wild white, (2) Morso, (3) New Zealand No. 1 (selection). Photographed 25th March, 1933, at six months old. Compare with fig. 5.

FIG. 5. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES WITH KENTISH WILD WHITE AND MORSO.

Three plots mid-centre, left to right—(1) Kentish wild white, (2) Morso, (3) New Zealand No. 1 (selection). Photographed, 9th August, 1933. Compare with fig. 4. The Kentish and the Morso are here producing poorly relatively to New Zealand No. 1 See Table 2.

[*Photos, E. Bruce Levy.*

available during dormant periods of growth; (2) the manuring programme for out-of-season growth may be designed with greater effect in dealing with long seasonal range plants than with those of a long dormant period, irrespective of how much manure is applied during the dormant periods of growth.

The clover of the sward is essentially the means by which the farmer gets value from phosphates—not that the grasses of the sward do not also immediately benefit from the phosphate dressing—but it can be said without fear of strong contradiction that phosphatic manuring gives but poor response until clover is reasonably well represented in the sward. That clover may be suckling clover, subterranean clover, white clover, or red clover according to the sward originally top-dressed, but in every case the primary effect of the top-dressing of phosphates is seen in the added growth of clover (fig. 9). This added clover growth gives a higher per acre stock concentration, and as more and more stock nitrogen is voided by the animals as a result of the higher carrying so do the grasses of the sward improve. The nitrogen fixation of the clover is also contributory to an improved grass growth.. This improvement in added grass growth may be regarded as a secondary effect of the original phosphates applied. Neither the primary nor secondary effects would accrue from phosphatic manuring if the clover were absent from the sward. This is fairly clearly illustrated in fig. 8, which is a photograph of the white clover production strain trials at Marton, which have been uniformly manured with phosphate and lime. The lighter-coloured plot on the left is a mixed sward sown out with an imported Dutch white clover; that on the right is a plot sown with the same general mixture, but with Kentish Wild White instead of imported Dutch; the part plot on the extreme right is a New Zealand No. 2 type. In these plots, where the clover has failed as a result of sowing a poor type, the grass sward is stunted and yellow in appearance—excepting where there are patches of stock nitrogen (darker patches appearing in the photo)—and not only is this general unthriftiness reflected in a much lower total yield, but the palatability of what feed is produced is much decreased.

A good type of white clover will pay for phosphatic manuring better than will suckling clover, subterranean clover, or an ordinary type of white clover. In other words, £1 per acre spent in phosphatic manuring will give a greater return from good strains of white clover than from ordinary strains, and this is particularly true in manuring for out-of-season growth. In the trails covered by Table 2 all plots had equal dressings of superphosphate, and it is plainly obvious that the better strains made the most use of such dressings (compare fig. 1).

In assessing the relative values of white clover strains, it must be pointed out that white clover is seldom, if ever, sown pure, and when combined with several other species of grasses and clovers there is a levelling-up in the production from the sward due to the species other than white clover competing for room and producing concurrently with the white clover and during those periods of low

white clover production. The art of formulating seed mixtures is bound up in blending species or strains that alternate rather than coincide in reaching their peak of production.

In a series of white clover strain trials conducted at Marton under the ægis of the Crop Experimentalist (Mr. A. W. Hudson) the influence of the mixture as against the pure sowing is clearly seen in assessing the relative production of the sown clover types. Here a New Zealand No. 1, New Zealand No. 2, ordinary New Zealand, Kentish Wild White, and Dutch white clover and a line

FIG. 6. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES WITH LINES OF AUSTRALIAN ORIGIN.

Left, New Zealand No. 1 (selections); right, two plots in foreground of Australian origin which fall into our reject for certification class. The third plot on the right is a New Zealand No. 1 mother-seed standard. Photographed 18th March, 1934, at eighteen months old.

[*Photo, E. Bruce Levy.*

of Montgomery red clover are sown out with a base mixture of certified perennial rye-grass, cocksfoot, and crested dogstail. Production is measured under the Hudson system of alternate mowing and grazing, and the relative performance of the white clover types in this trial over a period of eighteen months is set out in Table 3. It will be noted that differences in performance in this trial, although extremely significant, are entirely different from those in Table 2, where the measurements were made on pure clover plots. Dry matter determinations throughout the trial at Marton have been made by the Plant Research Station's chemist, Mr. B. W. Doak.

Table 3. — Showing Actual and Relative Production of White Clover Types when sown out in Association with a mixed Sward of Grasses. Trials conducted at Marton under the "Hudson" System of Alternate Mowing and Grazing. Sown 9th January, 1933.

(*a*) Total actual green weight in pounds produced for each period; (*b*) total dry matter; (*c*) relative total green weights produced for each period; (*d*) relative dry matter for each period. New Zealand No. 1 = 100 for each period in each case.

White Clover Type.	Period I,* 9th January, 1933, to 28th April, 1933: 109 Days.		Period II.* 28th April, 1933, to 24th August, 1933: 118 Days.		Period III,* 24th August, 1933, to 24th October, 1933: 61 Days.		Period IV,* 24th October, 1933, to 13th April, 1934: 171 Days.		Period V,* 13th April, 1934, to 14th May, 1934: 31 Days.		Period VI,* 14th May, 1934, to 10th July, 1934: 57 Days.	
	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)	(*a*)	(*b*)
New Zealand No. 1	19,616	2,997	5,555	1,044	9,905	1,765	32,720	5,774	2,148	402	3,014	555
New Zealand No. 2	19,009	2,912	4,971	949	8,853	1,647	26,933	5,032	1,968	378	2,434	480
Kentish Wild	19,444	2,993	5,624	1,024	9,385	1,725	25,296	4,754	2,128	408	2,610	512
Imported Dutch	19,523	2,958	5,178	959	9,421	1,720	18,147	3,668	2,231	428	1,719	363
New Zealand ordinary ..	19,441	2,962	5,193	980	8,692	1,616	23,589	4,534	2,199	422	2,185	444
	(*c*)	(*d*)	(*c*)	(*d*)	(*c*)	(*d*)	(*c*)	(*d*)	(*c*)	(*d*)	(*c*)	(*d*)
New Zealand No. 1	100	100	100	100	100	100	100	100	100	100	100	100
New Zealand No. 2	96·9	97·1	89·5	90·9	89·4	93·3	82·3	87·1	91·6	94·1	80·8	86·5
Kentish Wild	99·1	99·9	101·2	98·1	94·7	97·7	77·3	82·3	99·1	101·7	86·6	92·2
Imported Dutch	99·5	98·7	93·2	91·9	95·1	97·4	55·5	63·5	103·9	106·7	57·0	65·4
New Zealand ordinary ..	99·1	98·8	93·5	93·9	87·8	91·5	72·1	78·5	102·4	105·2	72·5	80·0

*Throughout periods I and II rye-grass was dominant and virtually the only species producing. In period III rye-grass was dominant with the clovers commencing to contribute to the sward. In period IV rye-grass was dominant at first, but later in the summer clover became dominant, particularly in the plots sown to the better types. In periods V and VI rye-gass again assumes dominance, but with some white clover, particularly the stronger-growing types, contributing well in the sward.

The significance of the figures in Table 3 may be seen in the summarized grand total of herbage produced (1) since the pasture was laid down to the last weighing on the 10th July, 1934—*i.e.*, over an eighteen-month period; and (2) since the time that the sown clover began to contribute to the sward—*i.e.*, since about the middle of August and over a period of eleven months.

Table 4.—Showing Actual Total and Relative Production of Pasture at Marton since Date of Laying-down and since the White Clover first commenced to contribute to the Sward.

White Clover Type.	From Commencement of Trial: Pasture Eighteen Months down.				From Period Clover commenced to Contribute to the Sward: Eleven Months' Period.			
	Green Weights: Pounds per Acre.		Dry Matter: Pounds per Acre.		Green Weights: Pounds per Acre.		Dry Matter: Pounds per Acre.	
	Actual.	Relative.	Actual.	Relative.	Actual.	Relative.	Actual.	Relative.
New Zealand No. 1 ..	72,957	100	12,537	100	47,787	100	8,496	100
New Zealand No. 2 ..	64,168	87·9	11,398	90·9	40,188	84·1	7,537	88·7
Kentish Wild ..	64,487	88·3	11,416	91·0	39,419	82·5	7,399	87·1
Imported Dutch ..	56,219	77·0	10,096	80·5	31,518	65·9	6,179	72·7
New Zealand Ordinary	61,299	84·0	10,958	87·4	36,665	76·7	7,016	82·5

The New Zealand No. 1 type used in this trial was seed from a mass selection made by the station at Palmerston North, and may be somewhat better than a normal New Zealand No. 1 ecotype. It will be seen, however, that this type is outstandingly ahead of any other type, with the New Zealand No. 2 and Kentish Wild White running about equal for second place. The New Zealand No. 1 type at Marton was the first clover to contribute to the sward in August, and apart from a one-month period between the middle of March and middle of April, which is difficult to account for at the moment, has done extremely well through the late autumn and winter period, as the actual and relative figures in period VI of Table 3 will indicate. Analyses of the cut herbage of the last weighings made on this plot during period VI showed the composition of the sward as follows: 62 per cent., rye-grass; 33 per cent., New Zealand No. 1 white clover; 5 per cent., odd species. The imported Dutch white clover plot has fared badly, and has shown itself unable to compete at all successfully with the associate grasses—mainly certified rye-grass—and at the date of writing little or no white clover is surviving in this plot.

A possible explanation of the slightly depressed yield of the New Zealand No. 1 type for the one-month period referred to may lie in the fact that this period is essentially a change-over from clover dominant to rye-grass dominant, the clover declining and the rye-grass recovering after autumn rains. There is just the possibility that during this period of change-over that the prior heavy clover growth suppressed the rye-grass somewhat, and the rye-grass recovery back to a full sward is somewhat slower than is the case where a less aggressive white clover type is present in the sward. This is fairly clearly shown in period V in the case of imported

Dutch white type, which for this period outyielded all others, due, no doubt, to the fact that the stand of rye-grass had not been affected by any competition from white clover during the immediately prior clover period.

The soil type at Marton prior to working, draining, and manuring carried a rather stunted sward of Brown-top. It is a soil type peculiarly free of volunteer white clover, and thus we may take it that the white clover content now secured there for these trials is as a direct result of the clover sown down in the mixture applied.

FIG. 7. COMPARISON OF NEW ZEALAND WHITE CLOVER TYPES WITH IMPORTED DUTCH AND KENTISH WILD WHITE.

Fore-left, imported Dutch white clover; right, Kentish wild white; mid-row from left, New Zealand No. 1; two plots New Zealand ordinary; certified permanent pasture. Third row back, single plant selections ex New Zealand No. 1 type. Extreme plot on left, New Zealand ordinary.

[*Photo, E. Bruce Levy.*

The results as set out in Tables 3 and 4 are by no means final, as it is intended to carry on these trials until such time as persistency of the types and a stabilized performance under the conditions of the trial are definitely shown.

As indicated above, in comparing the yields at Marton with those secured at the Plant Research Station at Palmerston North where the types are sown pure, the differences between one type and another are not so great; but, nevertheless, the differences are of such an order as to warrant one giving the greatest of care to the type of white clover included in any pastures sown.

Ecological Considerations in regard to White Clover Types.

Ecologically we may have to consider type in white clover apart from the total production of which any one strain is capable under an ideal set of conditions for growth, and this brings up the all-essential point of the grazing management and soil conditions in regard to strain—more particularly in regard to tall-growing and high-producing strains as distinct from low-growing and low-producing strains. In certain of our field plot trials that are being conducted on many soil types throughout New Zealand, while

FIG. 8. WHITE CLOVER AND ITS BENEFICIAL EFFECTS ON THE ASSOCIATE GRASSES OF THE SWARD.

A view of the white clover strain trials under the Hudson system of alternate mowing and grazing at Marton. Point analysing in progress. All clover types sown with certified rye-grass, cocksfoot, and crested dogstail. Plot on left includes imported Dutch white; that on right, Kentish wild white; and part plot on extreme right, New Zealand No. 2 type. The lighter colour of the Dutch plot reflects the pale, unhealthy state of the associate grasses compared with the dark-green of the Kentish wild white and other good clover types.

[*Photo, E. Bruce Levy.*

the New Zealand No. 1 is proving superior under almost all conditions sown, yet under certain styles of management the low-growing strains such as Kentish Wild White are giving the most pleasing swards, and we can well envisage a set of conditions where the Kentish Wild White will prove superior to any other type of white clover in New Zealand. Under reasonable treatment, however, we are inclined to place the main types of white clover in

the following order of agricultural utility: First, New Zealand No. 1 and selections therefrom; second, New Zealand No. 2; third, Kentish Wild White; fourth, Ordinary New Zealand; fifth, New Zealand Dutch and imported Dutch types.

Ecologically we would place these as follow:—

Group 1: New Zealand No. 1 commands a rich fertile soil-type—naturally fertile, or made so by top-dressing—where there is strong competitive growth for the greater part of the year, and where the grazing is lenient rather than severe.

Group 2: New Zealand No. 2. Fertile soil-types, but less so than 1, and where there is shorter growth with a corresponding lessening of competitive effects.

FIG. 9. WHITE CLOVER IN THE SWARD—THE KEY TO SUCCESS IN PHOSPHATE AND POTASH MANURING.

The primary effect of phosphate (or potash) manuring is reflected in the clover growth (right). This added clover by its nitrogen-fixation has a direct marked effect on the soil, and the extra growth produced raises the stock concentration per acre, which means more and more stock nitrogen for the grasses of the sward. [*Photo, E. Bruce Levy.*

Group 3: Kentish Wild White. Moderately fertile soil-type and where the growth is short and competitive effects are greatly reduced, particularly in the winter.

Group 4: New Zealand ordinary white clover. A fairly comprehensive range of soil-types and conditions where phosphatic manuring is practical, and where the sward is sufficiently open in the autumn to permit of reseeding. Essentially a volunteer type under cultivation, as in cereal and crop production, but not nearly so annually inclined as is the New Zealand Dutch and imported Dutch types.

FIG. 10. THE ECOLOGY OF WHITE CLOVER TYPES.

An eco-habitat in Hawke's Bay for New Zealand No. 1 white clover. Under lenient grazing with bullocks, associated with rank pasture growth spring and summer, the New Zealand No. 1 type is approaching the Station selections made ex this type, the highly competitive cover smothering out all but the high-producing tall-growing strains.

FIG. 11. THE ECOLOGY OF WHITE CLOVER TYPES.

The same eco-habitat as in fig. 10, under dairying. Here the white clover is a typical New Zealand No. 1 type. The New Zealand No. 1 type is also maintained here in an adjoining paddock under lenient sheep grazing.

[*Photos, E. Bruce Levy*

Group 5: New Zealand Dutch and imported Dutch types. Essentially free-flowering and quick-maturing annual types concomitants of arable farming where the annual crop plays an important part on the farm or where the sward so opens up in the summer as to afford every opportunity for re-establishment of the type from shed seed.

In groups 1, 2, and 3 we may regard the clovers as being true perennial types, provided they are not eliminated by smother or starved or grazed out of existence. The question to decide is just where each of these types fit in best so far as soil-type and sward management are concerned. It may be taken as a general axiom

FIG. 12. THE ECOLOGY OF WHITE CLOVER TYPES.

Almost identically the same eco-habitat as in fig. 10 under really excellent sheep management of the more or less set grazing type. Here the white clover dominant is a typical New Zealand No. 2 type. The question before us is, Could a New Zealand No. 1 type of white clover persist under a high sheep concentration under a rational system of rotational grazing?

[*Photo, E. Bruce Levy.*

that no white clover will produce well without phosphatic manuring, and we would tentatively say wherever conditions are sufficiently moist to render superphosphate available that the New Zealand No. 1 will respond the best to such manuring, but if these three clover types are left to their own resources as far as manuring is concerned, then we would say that the Kentish Wild White would survive longer than the New Zealand No. 1 or New Zealand No. 2.

As far as sward management—*i.e.*, method of grazing or utilization—is concerned, given a uniform soil-fertility condition we would expect from our experiences to date that the New Zealand No. 1 would excel under a somewhat lenient system of grazing, such as would obtain under a rational system of rotational grazing. The New Zealand No. 2 would excel under a somewhat more drastic system of grazing where the leafage is never allowed maximum

FIG. 13. NEW ZEALAND NO. 1 WHITE CLOVER TYPE COMPARED WITH OTHER TYPES UNDER VARYING DEGREES OF SOIL DRYNESS.

Soil type 1—fairly moist during summer. New Zealand No. 1 type is mid-plot behind front labels; on its left is a New Zealand ordinary type, and on its right an imported Dutch type. The part plot immediately in front of the New Zealand No. 1 is Kentish Wild White. Compare with figs. 14 and 15.

FIG. 14. NEW ZEALAND NO. 1 WHITE CLOVER TYPE COMPARED WITH OTHER TYPES UNDER VARYING DEGREES OF SOIL DRYNESS.

Soil type 2: Dry during summer period. New Zealand No. 1 is mid-plot behind front labels. The plot on the left is New Zealand No. 2 type dominant, and that on right is imported Dutch type. In the back row 1, 2, 3, and 5 from left are New Zealand No. 2 type. No. 4 is a New Zealand No. 1 type. Compare with figs. 13 and 15. [*Photos, E. Bruce Levy.*]

development. The Kentish Wild White would excel under a system of drastic, close, and continuous grazing, and it would outlast any other type of white clover given such treatment.

It is well known that cocksfoot, broad red clover, and Montgomery red clover produce but little feed and ultimately go out under a system of close and continuous grazing, and it is felt in strain-building work that this fate is awaiting high-producing strains of whatsoever species we choose to work on. The New Zealand No. 1 white clover and selections therefrom come essentially into

FIG. 15. NEW ZEALAND NO. 1 WHITE CLOVER TYPE COMPARED WITH OTHER TYPES UNDER VARYING DEGREES OF SOIL DRYNESS.

Soil type 3: Extremely dry during the summer period. New Zealand No. 1 mid-plot with a New Zealand No. 2 type on left and imported Dutch on right. In back row plot 1 is a New Zealand No. 2; 2 and 3, ordinary New Zealand; 4 and 5, New Zealand No. 2. It was noteworthy that when rains fell the New Zealand No. 1 made the best recovery on all soil types. Compare figs. 13 and 14. [*Photo, E. Bruce Levy.*

the category of tall-growing, high-producing types, and thus these are likely to give way to lower-producing types under a system of grazing that does not permit of its maximum growth. This is interestingly brought out in certain parts of Hawke's Bay, where normally the New Zealand No. 1 type of white clover abounds. Under a system of loose management where light grazing with cattle characterizes the management and where the growth in the spring and summer is usually rank and consists of Prairie grass, cocksfoot, rye-grass, and New Zealand No. 1 white clover dominant, the class of white clover in that area is almost equal to the Station selections made ex the New Zealand No. 1 type in growth and production. It is presumed this style of management over a

period of years has eliminated all types of white clover excepting the extra tall and vigorous growing types that alone were able to survive the dense smother from the competing grass growth. In the vicinity of the above paddock on the one side is dairying and the other side sheep. These are under typical dairy management and somewhat lenient sheep management respectively, and the typical New Zealand No. 1 type predominates (figs. 10–12). Within the same area where intense sheep-grazing has been practised over a long period of years the type of white clover is dominantly New Zealand No. 2, and it is presumed this type has survived and that the typical New Zealand No. 1 has been eliminated as a result of the severity of the grazing. The soil-type under review may be too highly winter-producing for the Kentish Wild White to persist, but it would not take much seeking to find areas of good country that are being closely and continuously grazed where the Kentish Wild White type of clover would persist after the New Zealand No. 1 and New Zealand No. 2 types had been eaten out. The inference to be drawn from this is that methods of grazing affect production from the same soil-type in relation to the production that may be secured from, say, the New Zealand No. 1 white and that from the Kentish Wild White type which produce, relatively, as approximately 2 to 1—*i.e.*, close and continuous grazing methods can possibly reduce production by fully 50 per cent. of what would be possible from that same soil under a more lenient system of grazing.

In grassland management, therefore, it seems a reasonable plan, when we know that the most desirable, high-producing species and strains thrive best under a system of grazing and spelling, to make every endeavour to suit our management to the demands of the pasture species or strains, so as to give them every chance to produce, rather than to accept low-producing, inferior species and strains because these fit in best with a system of grazing that is perhaps somewhat easier to carry out.

The call for a system of rational rotational grazing becomes more and more imperative as strain-building, incorporating high production as an essential feature, proceeds. Experiments are in hand to test out types of white clover under varying methods of defoliation: (1) Under close and continuous grazing by sheep; (2) under normal set stocking with sheep; (3) under rotational grazing by sheep. Mowing will also be made: (1) Close and continuous, (2) moderately frequent, (3) at a stage when grazed under the rotational grazing system as applied with sheep above. This work will give some information on the effects of severity or leniency of defoliation in regard to type, and this information really is necessary before the production of pedigree seed can proceed with full and complete confidence that the best strains are being evolved for, maybe, a rather wide set of conditions necessitated through the practical limitations of the farmer or locality. In agriculture, as in all phases of industry, the ideal conditions for production cannot always be economically secured, and in preparing for an all-round advance an eye must be kept on the economic developmental phases that precede the ideal. Hence, in pedigree-seed-production work it is possible that more than one strain of any one species

will require attention. At the present time the Plant Research Station is building towards pedigree strains in relation to New Zealand No. 1 white clover, but time and experience alone over a wide range of soil-types and conditions will indicate whether New Zealand No. 1 type is the only type that should be produced on a pedigree basis.

Evidence accumulating from Field Trials.

Definite clover types have now been sown out in twenty-three experimental sowings throughout New Zealand under average field conditions, and thirty more lots are being prepared for sowing this coming spring and autumn. Generally speaking, the indications to date from these trials are that the New Zealand No. 1, in the early years of the sward, at least, is the best type under average to fertile soil conditions, and is superseded in but a few trials only by other types on harder and more impoverished soil conditions. From these field trials comes evidence of two kinds in relation to sown clover types: (1) In the dry, harder habitats no differences are discernible between one type and another, and it is just a question whether the sown clovers have established. In certain instances it is definitely the case that failure of the sown white clover to establish is responsible for the little or no differences seen. Where a fair establishment has been effected under hard conditions, field reports are in favour of Kentish Wild White as making the best sward, although even here the New Zealand No. 1 is well to the fore. (2) In the case of those trials where the conditions have been sufficiently moist for germination and establishment of white clover to become effected, the evidence is outstandingly in favour of the New Zealand No. 1 type as being superior to all other types, but with Kentish Wild White scoring in appearance under closely grazed conditions or where the conditions are less fertile. It is reported by most observers and emphasized that the health and colour of the associate grasses of the sward is better wherever a good stand of white clover is secured, and the influence of the more vigorous types of white clover on sward palatability has been recorded in many of those field-plot trials. In certain instances certified perennial rye-grass plus New Zealand No. 1 white is proving more palatable than false perennial rye-grass lots that are associated with a poor clover type.

A field trial laid down at Palmerston North on a light undulating sandy and shingly soil-type that dries out badly in the summer, particularly on the crests, is of interest in respect to performance of the New Zealand No. 1 type as against all other types. On this area some five hundred lines of white clover were sown, including all New Zealand types and some from overseas. Figs. 13–15 indicate under three soil conditions the superiority in growth and persistency of the New Zealand No. 1 type, and in Table 5 are set out persistency data in the second summer period of these trials.

This trial was conducted under a somewhat lenient system of grazing with sheep, and this may have favoured persistency of the New Zealand No. 1 type as against Kentish Wild White, for example, which suffered considerably by volunteer grass invasion. This latter type was sown on only the better soil-type. The Dutch types were entirely replaced by weeds and volunteer grass after eighteen months down, and it would appear as though no method of grazing would perpetuate this type.

Table 5.—Showing relative Performances of White Clover Types on Three Soil-types during a Drying-out Summer Period, 1933. Point Analyses made 6th March, 1933.

Clover Type.	Soil Type 1: Percentage of Ground Cover.			Soil Type 2: Percentage of Ground Cover.			Soil Type 3: Percentage of Ground Cover.		
	White Clover.	Bare Ground.	Weeds.	White Clover.	Bare Ground.	Weeds.	White Clover.	Bare Ground.	Weeds.
New Zealand No. 1	64	34	2	60	37	3	33	63	4
New Zealand No. 2	63	28	9	47	49	4	31	67	2
New Zealand Ordinary	41	53	6	28	62	10	19	78	3
Imported Dutch	17	56	27	8	75	17	6	76	18
Kentish Wild White	53	38	9	..	..	..	..	..	..

In conclusion, the New Zealand No. 1 type of white clover is outstanding, and it sets an ideal for even the most up-to-date farmer to strive for, an ideal that will reflect optimum manuring, efficiency in herbage utilization, and the maximum in production. New Zealand No. 2 and Kentish Wild White also afford good types of clover for intermediate soil types and conditions, but it is our opinion that wherever the conditions on the farm favour fair to good white clover growth that the New Zealand No. 1 type ultimately should be sown, and every endeavour made by manuring and management to make this the dominant white clover type on the farm. At present the supply of seed of New Zealand No. 1 type is extremely limited. It is sold as New Zealand certified white—mother-seed standard; New Zealand No. 2 is sold as New Zealand certified white—permanent pasture standard; and seed of Kentish Wild White would need to be imported, as there are no supplies of this clover in New Zealand at the present time.

SOME GUIDANCE RELATIVE TO SEASONABLE CARE OF DAIRY COWS.*

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The modern dairy cow has, by a process of selection, been evolved into a highly specialized organism and, with the primary object of heavy milk-yield being the guiding principle of this selection, the stamina of the animal has, to a certain degree, been neglected. In consequence, the cows of to-day require more attention to keep them in good health than did their ancestors of fifty years ago; and the complaint of the dairyman that it is always his best cows that seem to get into the most trouble has some foundation in fact. Calving-time is a critical period with all cows, particularly with the high producer, and more attention could well be given to measures which minimize trouble at this season.

Of considerable importance is the question of shelter from the inclement weather. The cow, like all other animals, requires food to produce energy and warmth. It takes a definite amount of food to produce a definite amount of heat and, as the healthy animal body must remain at practically a constant temperature, a moment's

* Substance of lecturette broadcast from Station 2YA.

reflection will show that an animal kept warm and dry will require less food than the one that is wet and cold. But, alas! Often the wet and cold beast gets less food than her better-cared-for sister. Hence, the provision of shelter-belts of trees, live hedges, and rugs is a distinct economic advantage to both man and beast. If such provision is not practicable for all the farm stock, every endeavour should be made to provide suitable accommodation for the cows about to calve. The ideal is a snug, level paddock close to the homestead and surrounded by hedges in which all cows can be calved — a maternity home, as it were. When it is seen that a cow is within a few days of calving, she should be taken to this paddock and kept under observation—given assistance if necessary, and carefully watched for at least two days after the calf is born for any sign of the onset of parturient paresis or so-called milk-fever. Further, observations relative to the incidence of contagious abortion may be made more readily if cows are calved in such a paddock. The term "milk-fever" is really a misnomer, as the patient's temperature, instead of being raised, is subnormal.

The direct cause of parturient paresis is a temporary deficiency of calcium in the bloodstream and recent research has shown that injection into the circulation of suitable calcium salts can, in many cases, bring about recovery, but for general treatment, the older method of udder inflation is still the most satisfactory. For a particular cow that one thinks is likely to go down with milk-fever, a preventive drench of 2 oz. of calcium chloride in a quart of water may be given at calving-time, but this precaution does not absolve the owner from being prepared for the onset of an attack later on.

There is ample justification for emphatically warning farmers against drenching a cow when she is actually suffering from an attack of milk-fever, as, at that time, the animal has no nervous control over her throat and some of the medicine is just as likely to go down the windpipe into the lungs, as down the right way into the stomach. Any quantity of foreign matter going into the lungs gives rise to a fatal pneumonia. It often happens in milk-fever cases that have not been found until the cow has been down and lying on her side for some hours, that the paunch is full of gas, and green matter is oozing from the unconscious patient's nostrils. The cow responds to treatment for milk-fever, but a few days later, is dead from pneumonia caused through breathing into the lungs some of that green matter that had come up from the stomach when she was lying on her side. With the maternity paddock in use, this particular cow would have been noticed when symptoms of milk-fever first developed, and she would not have been allowed to reach the stage when stomach contents come up into the nostrils.

In a case of milk-fever it is essential, after the udder has been inflated, that the patient be kept up on her brisket by such means as a bale of hay or a sack of chaff, hay, or earth forced in behind her shoulder blade. It is well to remember that she is suffering from a species of shock and has lost a good deal of heat, so cover her up with plenty of straw, rugs, sacks, &c., and then leave her alone for an hour or two. When consciousness has returned, a drink of luke-warm water may be offered to her, but one should not be in a hurry to force anything down her throat. If she has not made progress towards recovery within, say, three hours, it is advisable to inflate her udder again. The danger of udder inflation is that infection may

be introduced into the organ, if cleanly methods are not practised, with a very bad form of mammitis as a sequel. Therefore it is necessary to be particularly careful to cleanse the teats thoroughly and to pay attention to the teat siphon, which should be sterilized immediately before use. This is best done by boiling the instrument in a small saucepan of water for five minutes. Then proceed as follows: Remove the saucepan from the fire and carry it and its contents to the patient's side. Be careful when using the teat siphon not to handle that part of it which is to be introduced into the cow's teats. Milk out what little milk there is in the udder and carefully insert the siphon into the teat canal for about an inch, and then use the pump at a reasonable rate of speed, until the quarter is expanded fairly tightly with air. Withdraw the siphon and pinch the end of the teat with the thumb and forefinger for a few seconds. Some air will escape, which is of no moment. However, if thought desirable, in cases of very easily milked cows, a piece of rag or tape may be tied around the teat to prevent further leakage of air, but the ligature should not be left on for more than about a quarter of an hour, as its retention may lead to serious injury of the teat. Repeat this treatment with the other quarters and then prop the cow on her brisket and cover her up as described before. It is to be remembered that a cow may go down with milk-fever again after recovery from the original attack, so that it is advisable to keep the patient under observation for a day longer.

As a general rule, milk-fever is associated with recent parturition, but occasionally a cow goes down before the calf is actually born. Then, there are those cases which show all the symptoms of milk-fever, but, as the animals have not recently calved, the owner is misled, and decides that they cannot be suffering from this complaint. Both these types of cases respond to treatment for parturient paralysis, and one should not hesitate to inflate the udder when a cow, under any circumstances, shows symptoms simulating milk-fever.

There is a form of paralysis that often occurs a few days after calving in which the cow seems to lose the use of her hind legs, and is unable to raise herself from the ground. Temperature, eye, and appetite appear about normal, and the cow remains in the natural recumbent position making occasional futile attempts to get on her feet. Provided the patient is in a sheltered place, she may remain where she is, but, otherwise, it is desirable to sledge her into a convenient shed. As a preliminary treatment, give ½ lb. to 1 lb. of Epsom salts dissolved in 1 to 2 quarts of hot water, and follow this immediately with 4 oz. of baking-soda dissolved in 1 quart of *cold* water. Give ½ oz. doses of powdered nux vomica in a little water twice daily for three to five days. If the bowels are not functioning well after the first day, smaller doses of Epsom salts, say 4 oz. to 8 oz., should be given daily. Sometimes a plaster is applied to the loins and rump, and this may be made as follows: Take two tablespoonfuls of mustard and an equal quantity of flour, mix with cold water until the mass is of the consistency of thin cream, rub on to parts, and finally put a sheet of thick brown paper over the plaster. A balanced ration should be given consisting of good hay, green feed, and a few roots if available, together with a plentiful supply of drinking-water. Prairie-grass is particularly good as a part of the green feed. Do not be in a hurry to get the cow on her feet, but let her lie comfortably for several days, seeing to it that she has plenty of bedding. If she

has ceased making attempts to rise by the fourth or fifth day, try giving her a sudden fright with a dog or other means, and often she will succeed in getting on her feet. If this fails, leave her for another day and then get her up by lifting with man-power, if enough is available, or, as a last resort, sheer-legs with slings and a block and tackle may be used. The cow should be supported until she takes her own weight. If the animal cannot then stand alone, allow her to lie a few more days. Most cases recover within a week, and it is wrong to keep a cow in slings for any length of time. The trouble just described is not to be confused with that of those beasts which are unable to rise to their feet simply through sheer weakness due to bad management during autumn and winter. Before treating a cow that cannot rise from the ground, one should make sure that her inability to do so is not due to a fractured pelvis or limb.

The question of the desirability of giving each cow a drench after calving is an open one, but, provided care is taken in administering the medicine, no harm is done and often benefit is derived—½ lb. to 1 lb. of Epsom salts with a tablespoonful of ground ginger dissolved in a quart of water is quite good for this purpose.

It is essential that the calf should have the colostrum or beastings, and, in practice, the mother and offspring should be left together for a day. According to law, milk or cream from a cow which has calved for less than four clear days cannot be sent to a dairy factory, and, furthermore, in the export veal trade a calf has to be at least five days old, so the calf can, without any pecuniary hardship to the dairyman, be fed on its dam's milk for four days. The calf should be kept warm and dry, this applying especially to the vealer, so that the pen in which it is placed before collection by lorry should be wind and rain proof.

The development of the calf is a big strain on a cow at any time, calling especially on her mineral reserves, and, after coming through a lean winter, as so many cows do, the animals enter the milking season with these essential reserves more or less exhausted. Chief among the reserve minerals used up is calcium phosphate, which is also one of the important mineral salts of milk, and it is important that ample supplies of calcium phosphate should be available so that the milking-cows can replete their systems as soon as possible. To this end, a lick composed of equal parts of steamed bone-flour and common salt should be made available to the dairy herd. If there is a phosphatic deficiency in their systems, the cows will literally eat this mixture, but, so soon as reserves are built up in the body, an animal's craving for the lick will cease.

If a cow is in good health at calving-time, the cleanings will come away within a few hours after parturition, but, due to various causes, many cows suffer from retained placentæ. Naturally, the farmer desires this condition remedied as soon as possible, but the better way is to "hasten slowly" in this case, and leave things to nature a little. More harm is done in hasty interference than in letting things alone for a few days. The external portion may be shortened a little, but the practice of tying horse-shoes, bricks, &c., on to the dependent part is to be condemned—rather endeavour to build up the animal's health with good feeding and a drench or two. The "washing out" of each and every cow just after calving is not a desirable practice, but in those cases where a douche is really required, use plenty of fluid, say 4 to 8 gallons with a very small quantity of disinfectant added.

If the dairy cow is to fulfil her function it is necessary that her udder remain free from disease during the milking period, and I will conclude my suggestions with a few remarks regarding mammitis.

The udder of the present-day cow is a highly specialized organ selected solely for milk-production, but, unfortunately, this particular selection has lowered its resistance to disease, and so every possible precaution should be taken to protect the udder against infection. Attention to shelter, food, &c., are of importance in this respect.

One should endeavour to ensure that gateways and approaches to the milking-shed are such that the cows' udders and teats do not come in direct contact with mud, which means practically that mud nowhere should be more than 6 in. deep. Remember that such mud contains great numbers of pathogenic organisms. Care should be taken that the milking-machines are not working with a greater vacuum than 15 lb., and that the gauge is correct. The teat cups should not be left on too long, and, when stripping by hand there is no need to tug at the cows' udders. A good practice is to wash the cows' teats with a solution of hypochlorite or potassium permanganate both before and after milking. This practice will tend to prevent the spread of cow-pox and infection with mammitis germs. When potassium permanganate solution loses its original colour and becomes brownish, it is useless as a disinfectant, so it is advisable to change the solution in the washing-bucket frequently. A good ointment for use on the cows' teats may be made as follows: Take 4 lb. petroleum jelly, 4 lb. good mutton tallow, and 1 lb. boracic acid. Melt petroleum jelly and tallow together in a tin, then remove from fire and stir in the boracic acid, beating the mixture until it sets.

USE OF WOODEN CRATES FOR SEED POTATOES.

J. O. WALLACE, Department of Agriculture, Dunedin.

SINCE the inception of potato-growing in New Zealand, the use of the sack as a container, both for seed and table potatoes, has been an invariable practice, and any suggestion embodying a departure from established usage in this connection will no doubt be viewed by growers and the trade with natural reservation. Despite this, however, it was considered that there might be definite scope for the development of sales of certified seed potatoes in suitable wooden containers, and permission was obtained to investigate this possibility in Dunedin. The writer has been intimately connected with the scheme since its inception, and now that it is likely to be extended, this short statement may be of interest to both growers and merchants.

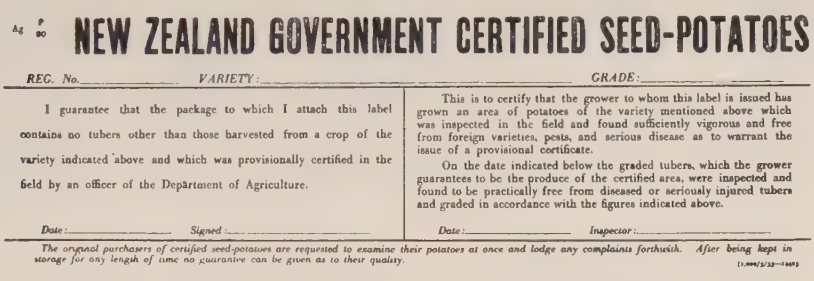
In America and Canada wooden crates for the purpose mentioned are no novelty. They have been in use for some years, and are rapidly displacing the sack. They are principally and extensively used in the certified seed trade and by co-operative marketing associations in marketing selected table potatoes.

To New Zealand growers they may appear to be a novelty, but those specializing in the production of certified seed will realize that crates possess obvious advantages over the sack.

The suggested use of crates may be criticized because of the extra expense which an innovation of this nature might involve, and while

such an argument might at first appear perfectly justified, there are, nevertheless, some worthy features in the suggestion that deserve full consideration.

It is apparent from inquiries received in the past that there is a keen demand by private gardeners for genuine certified seed potatoes, and it can be said safely that herein lies a potential market that has not yet been explored in a practical way by growers. It is thought that the use of crates will facilitate catering for this demand. The use of crates would to a large degree prevent much of the trouble that arises from the bruising and the subsequent rotting of tubers that so often happen during inter-Island transport when sacks


NEW ZEALAND GOVERNMENT CERTIFIED SEED-POTATOES

REG. No._____ VARIETY:_____ GRADE:_____

I guarantee that the package to which I attach this label contains no tubers other than those harvested from a crop of the variety indicated above and which was provisionally certified in the field by an officer of the Department of Agriculture.

Date:_____ Signed:_____

This is to certify that the grower to whom this label is issued has grown an area of potatoes of the variety mentioned above which was inspected in the field and found sufficiently vigorous and free from foreign varieties, pests, and serious disease as to warrant the issue of a provisional certificate.

On the date indicated below the graded tubers, which the grower guarantees to be the produce of the certified area, were inspected and found to be practically free from diseased or seriously injured tubers and graded in accordance with the figures indicated above.

Date:_____ Inspector:_____

The original purchasers of certified seed-potatoes are requested to examine their potatoes at once and lodge any complaints forthwith. After being kept in storage for any length of time no guarantee can be given as to their quality.

FIG. 1. STICKER LABEL TO BE ISSUED TO GROWERS.

NEW ZEALAND GOVERNMENT CERTIFIED SEED-POTATOES

We guarantee that the package to which we have attached this label contains no seed tubers other than those supplied to us by registered grower No._____ _____and in respect to which we have received a guarantee signed by the grower declaring them to be Government certified seed of the variety

_____ (Insert variety.)

*Permit to repack issued on*_____ *Signed* _____

by_____

Inspector, N.Z. Department of Agriculture.

FIG. 2. STICKER LABEL TO BE ISSUED TO REPACKERS.

are used. Trial cased lots sent from Dunedin to Palmerston North last year were found to be in perfect condition when opened, after having been kept at their destination for a considerable length of time.

The Department of Agriculture therefore had printed for this initial trial, sticker certification labels specially adapted for use on crates, to replace the tie-on tags issued to growers who customarily market their produce in sacks (fig. 1).

The position of retail seedsmen wishing to repack bulk lines into standard crates was not overlooked, and a special sticker label to meet their needs was also prepared (fig. 2). Repacking of bulk lines into wooden crates, and the use of these labels was permitted only under official supervision, and a charge of 6d. per hundredweight, with a minimum charge of 10s., was made in this connection.

FIG. 3. 14 LB. CRATE.

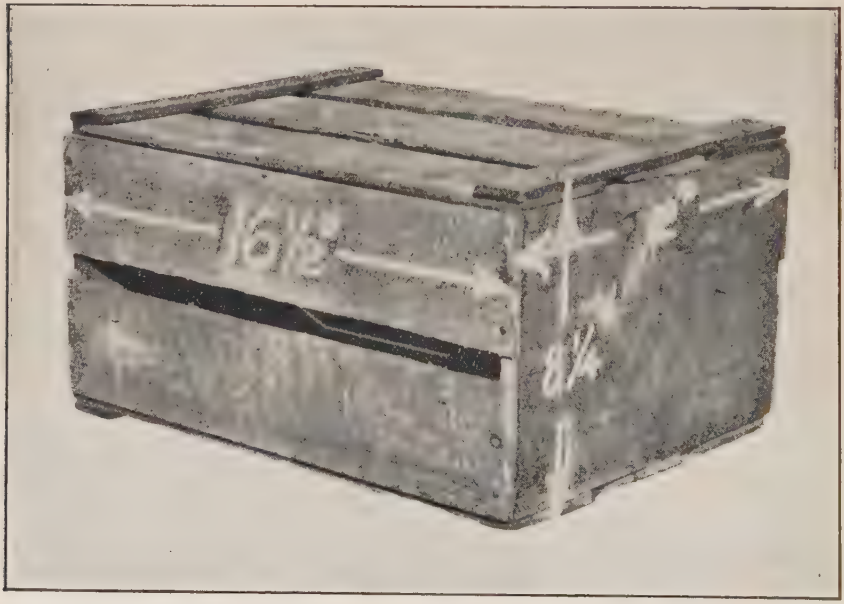


FIG. 4. 28 LB. CRATE.

Timber Specifications for Crates.

—	14 lb. Potato-crate.	28 lb. Potato-crate.	56 lb. Potato-crate.
	In. In. In.	In. In. In.	In. In. In.
Crate, inside dimensions ..	15½ x 3⅞ x 11½	15½ x 7¼ x 11½	17½ x 11½ x 11½
End pieces	(2) 11½ x 3⅞ x ⅜	(2) 11½ x 7¼ x ½	(2) 11½ x 11½ x ¾
Side slats	(2) 16½ x 3¼ 1 ¼	(4) 16½ x 3¼ x ¼	(6) 19 x 3½ x ¼
Top and bottom slats	(6) 16½ x 3½ x ¼	(6) 16½ x 3¼ x ¼	(6) 19 x 3½ x ¼
Cleats	(4) 11½ x 1⅜ x ¼	(4) 11½ x 1⅜ x ¼	(4) 11½ x 1⅜ x ¼

(The figures in parentheses denote the number of pieces required.)

With the object of preventing the possibility of unscrupulous individuals endeavouring to pass on to the public ordinary seed as genuine certified seed, all crates when packed and bearing official certification labels were sealed in such a manner as to prevent any one tampering with their contents.

Many styles of crates were considered, and that recommended for New Zealand conditions closely resembles the most popular crate used in America. The trial crates were constructed of New Zealand beech timber, which proved satisfactory in every way, and is accordingly recommended for this purpose.

In the initial stages of introducing the crates to the trade, three sizes were considered sufficient, and were made to hold respectively 14 lb., 28 lb., and 56 lb. Further experience may indicate that a 112 lb. crate will be required for the inter-Island trade. The 14 lb. and 28 lb. crates are illustrated in figs. 3 and 4.

In designing the crates the problems of the packer, as well as of the miller, have been kept in mind, and an endeavour has been made to have parts interchangeable in assembly as far as possible. In the case of the two smaller crates it will be noted that the ends are the only parts which differ in size.

The cost will vary according to locality and distance of mill from railhead, but, as an indication of prices likely to rule, quotes for shooks of beech crate-timber of the above specifications have been obtained at 5d., 4d., and 3d. for 56 lb., 28 lb., and 14 lb. respectively.

In conclusion, it is desired to express thanks to Mr. J. R. Wilson, of Sharps Sawmills, Tawanui, for assistance rendered in designing the trial crates, and for help in their construction.

The success that has attended the initial trial of crated certified seed potatoes has led to a decision to extend these facilities to any part of the Dominion. Particulars may be obtained from the Field Superintendents at Dunedin, Christchurch, Palmerston North, and Auckland.

—J. W. Hadfield, Agronomist.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 12th July to 26th July, 1934, include the following of agricultural interest:—

No. 70271: Hay-stacker; G. Butler. No. 70528: Cultivating implement; R. J. Bowen. No. 71834: Separator; G. D. Chambers. No. 72048: Milking-system; G. H. Gascoigne and J. R. Knox. No. 72049: Milking-system; G. H. Gascoigne and J. R. Knox. No. 72050: Securing wire; L. A. Miller and W. T. Howse. No. 68854: Cheese-press; G. J. G. Fraser. No. 71021: Egg-grading machine; A. Martin. No. 71343: Watering-can; A. Billens. No. 72108: Cutter for shearing-machine; J. J. Bourke. No. 72129: Preventing the deterioration of milk; R. L. Feagles. No. 72176: Hay-knife; J. G. Mattson and A. Cahill. No. 72211: Fruit-case; C. H. Miller. No. 72233: Incubator; L. T. Hayman. No. 72241: Cultivator-point; J. M. Deschamps. No. 72281: Storage of milk; The Aluminium Plant and Vessel Co., Ltd.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

CERTIFICATION OF SEED POTATOES.

CROPS PASSED TUBER INSPECTION DURING JULY, 1934.

APPENDED is a list of growers whose crops have been subject to and have passed the tuber inspection in connection with the system of Government certification of seed potatoes conducted by the Department of Agriculture. The list supplements that published in the July Journal and refers to those crops passed during July. Further lists will be published in later issues.

In the June *Journal* was published a list of growers who have received provisional certificates. The acreage, percentages of foreign varieties present, and the group number and classification representing the relative merits of lines were given in that list, to which intending purchasers should refer.

AUCKLAND SHORT TOP.

Mother Seed—
Barrett, W. H., Springlands, Blenheim.
Caldwell, G., R.M.D., Courtenay.
Cross, A. E., Pine Farm, Bennett's, via Rangiora.
Crozier, W. J., Mount Hutt, R.D., Rakaia.
Ham, A., Grovetown, Blenheim.
Henderson, G., R.M.D., Courtenay (Line A).
Henderson, G., R.M.D., Courtenay (Line B).
Kenyon, F., Mina, North Canterbury.
Martin, W. E., R.M.D., Kaiapoi (Line A).
Morgan, D., Cheviot, North Canterbury.
Petrie, H. H., R.M.D., Swannanoa (Line A).
Petrie, H. H., R.M.D., Swannanoa (Line B).
Petrie, J., sen., R.M.D., Swannanoa.
Redmond, C., R.M.D., Kimberley.
Roper, P. F., R.M.D., Halkett.
Ryan's Estate, R.M.D., Springston.
Westaway, R. J., R.M.D., Courtenay.

Commercial Seed—
Adams, K. and R., Sheffield.
Gray, J. L., St. Andrew's.
Gray, R., St. Andrew's.
Kelleher, T., Pleasant Point, Timaru.
Musson, W., Rangiora.
McKenzie, J. R., Yaldhurst.
Oliver, J. O. J., Temuka.
Porter, E. G. Y., St. Andrew's.
Rangiora High School, Rangiora (Line A).
Rangiora High School, Rangiora (Line B).
Rich, A. J., R.M.D., Kaiapoi.
Smith, E. A., R.M.D., Springston.
Timaru Boys' High School, Timaru.

DAKOTA.

Mother Seed—
Allen, A., R.M.D., Leeston.
Chambers, A. J., "Carberry," Weedon's.
McPhail, W. A., Mitcham, via Rakaia.
Petrie, J., jun., R.M.D., Swannanoa.
Petrie, J., sen., R.M.D., Swannanoa.
Rolston, G., R.M.D., Weedon's, Courtenay.
Walker, C. E., R.M.D., West Melton.
Wilson, M., R.M.D. Halkett.

Commercial Seed—
Boag, R. A., R.M.D., Greendale.
Burrows, J., Mount Hutt Rural, Rakaia.
Campbell, D., King Street, Rangiora.
Cross, A. E., Pine Farm, Bennett's, via Rangiora.
Foster, T. C., Ladbrooks (Line B).
Gray, R., St. Andrew's.

DAKOTA—*continued.*

Commercial Seed—continued.
Ham, A., Grovetown, Blenheim.
McIntosh, H. J., Kaiapoi.
Robson, F. H., Box 22, Lincoln.
Seivwright, R. M., Meadows, Washdyke.

KING EDWARD.

Mother Seed—
Griffin, J. G., Te Waewae, Southland.
Kokay, S., Tuatapere.
Mehrtens, L. C., Box 27, Tuatapere.

Commercial Seed—
Wilkins, J. H., Milton.

JERSEY BENNES.

Mother Seed—
Burgess, D., West Plains, Invercargill.
Milburn, M., R.M.D., Wright's Bush, Gladfield.

EARLY REGENT BOLTER.

Mother Seed—
Pascoe, S., R.M.D., Halkett.

GREAT SCOT.

Mother Seed—
Wright, L. T., Annat.
Wright, Q., Annat.

ARRAN CHIEF.

Mother Seed—
Mehrtens, L. C., Box 27, Tuatapere.
Poninghouse, W. L., Tai Tapu.
Robinson, R. G., Box 4, Papanui, Christchurch (Line A).
Teschner, C. A., Chatton Road, Gore.

Commercial Seed—
Barclay, G. M. M., Riverside Road, Waimate.
Saunders, E. E., Studholme Junction (Line A).

ARRAN BANNER.

Mother Seed—
Sheddan, G. B., R.M.D., Otahuti, Invercargill.
Wilson, C. H., Lorneville, Invercargill.
Wright, L. T., Annat.

Commercial Seed—
Henderson, G., R.M.D., Courtenay.
McNae, F., R.M.D., Courtenay (Line A).

AUCKLANDER TALL TOP.

Mother Seed—
Steele, F., Fernside, Rangiora.

—*Fields Division.*

At Waikuku, Canterbury, a lucerne stand now in its third season was sown with half a ton of carbonate of lime and 2 cwt. super, but without inoculation. The seed was drilled through every coulter of a grain drill and an excellent strike was obtained. The lucerne, however, remained stunted and yellow until 3 cwt. of inoculated soil per acre was applied this season following cultivation with a suitable grubber. The stand is now an excellent one.

LIVE-STOCK IN NEW ZEALAND, 1934.

UNLESS OTHERWISE SPECIFIED, ENUMERATED AT 31ST JANUARY.

Land District.	Horses as at 31st Jan., 1934.	Dairy Cows as at 31st Jan., 1934 (in Milk and Dry).	Total Cattle as at 31st Jan., 1934 (including Figures in previous Column).	Number of Sheep shorn, Season 1933-34.	Number of Lambs shorn, Season 1933-34.	Number of Lambs tailed, Season 1933-34.	Sheep (including Lambs) as at 30th April, 1934	Pigs as at 31st Jan., 1934.
North Auckland	29,700	364,108	678,078	909,763	200,296	481,569	1,018,624	112,813
Auckland	44,190	595,250	1,056,633	1,383,314	370,308	931,935	1,563,899	227,887
Gisborne	15,974	62,860	414,631	2,709,833	822,657	1,374,434	2,979,519	22,607
Hawke's Bay	13,126	66,203	258,282	2,794,808	462,107	1,770,304	3,131,301	20,013
Taranaki	17,618	262,823	444,571	821,142	240,065	522,914	872,565	68,345
Wellington	34,804	267,039	751,680	5,291,847	1,326,165	3,304,413	5,787,498	91,889
Nelson	5,693	35,279	73,972	380,127	17,719	167,915	433,958	16,778
Marlborough	5,962	18,404	44,185	1,014,693	18,598	439,737	1,068,360	6,794
Westland	2,011	16,333	46,412	66,510	7,537	50,841	78,804	6,223
Canterbury	51,577	88,658	189,398	4,350,856	21,842	2,858,557	5,350,165	46,789
Otago	29,654	66,407	152,350	3,273,241	6,243	1,822,039	3,899,032	23,905
Southland	23,629	89,167	190,723	2,021,655	6,700	1,550,039	2,462,497	16,344
Preliminary totals, 1934 ..	273,938	1,932,531	4,300,915	25,017,789	3,500,237	15,274,697	28,646,222	660,387
Final totals, 1933 ..	276,897	1,845,972	4,192,023	25,069,409	2,629,837	15,015,628	27,755,966	591,582

—Census and Statistics Office.

SEASONAL NOTES.

THE FARM.

Seed-beds for Pastures.

WHEN the sowing of pasture mixtures is followed by results which can truly be characterized as failures, farmers relatively often request officers of the Department to endeavour to indicate why such failures have occurred. In this way a wide and varied experience relative to poor results from the sowing of pasture mixtures has been obtained. From this experience it seems as if it is not realized as widely as is desirable that in the establishment of pastures a matter of fundamental importance is the preparation of the seed-bed. Partly because of the size of the seeds widely used and partly because of the requirements of the resultant plants a fine firm seed-bed is necessary. Firmness of the seed-bed is of especial importance; at times failures which are attributed to poor vitality in seeds are found to be due to lack of firmness in the seed-bed—sometimes in areas which are almost complete failures there are small areas of successful "strikes" of seed around headlands or in other places which have been consolidated by the passage of implements or of stock. These small areas in which success has been obtained indicate that not the seed, but the lack of consolidation, is responsible for the general unsatisfactory establishment. Lack of adequate firmness is specially prone to occur in soils naturally loose—*e.g.*, those which are sandy or peaty—but at times it is prominent on heavier soils. The advisability of firmness in seed-beds for pastures is of current moment, because the most effective and economical means of securing appropriate firmness is cultivation commenced early enough and carried out thoroughly enough. The most desirable firmness is that which results from the joint effects of natural agencies such as weathering and of cultivation, and which calls for the lapse of time to supplement tillage. Cultivation, without adequate time for weathering, may readily lead to a cloddy soil which it is practically impossible to turn directly into a good seed-bed even though the individual clods are comparatively small. Such cloddy soils sometimes result on heavier types of soils from a relatively late ploughing which buries a layer of weathered mould and replaces it by a layer which is lumpy when the land dries, and which is a poor seed-bed. It seems to be overlooked commonly that firmness is required not so much in the immediate surface portion as in the soil which lies beneath it and extends to the full depth to which cultivation has been carried out. This explains why the firmness that can be obtained at the surface by the use of the roller is not at all sufficient. Disking, cultivating, or grubbing and harrowing are the pulverizing operations which, in conjunction with natural disintegration, will most readily give the firmness throughout the cultivated layer of soil which is desirable. Often too much dependence is placed upon the roller, which, as commonly used, effects consolidation only in a shallow surface layer. If the roller is used immediately after ploughing, it may be of some value in consolidating the lower portion of the layer being cultivated by directly pressing the furrows against the unbroken earth beneath, but later when the upper portions of the furrows are levelled out by tillage the pressure of the roller is more widely distributed, and hence not felt so heavily at any particular point. No implement in use in New Zealand will pack by pressure the portion of the cultivated soil with which the roller does not satisfactorily deal, and so time-saving measures in the preparation of seed-beds for pastures are as a rule not advisable—rather dependence should be placed on the pulverizing of the soil in good time by such measures

as disking and cultivating, which penetrate deeply enough to eliminate a loose condition a few inches below the surface of the soil. It is not to be deduced from the above statement that rolling is of little value ; it reduces the surface soil to a good tilth and consolidates it to form a firm layer of soil in which the soil is well packed round the seed, and it facilitates the freer rise of moisture to a position from which the seeds may use it. Where consolidation is required as in pasture establishment it is normally good practice to roll before sowing to secure firmness under the seeds, which may be suitably covered by a light harrowing such as is obtained by the use of chain or brush harrows.

An unsuitable seed-bed is reflected particularly readily in poor results from clover seed, which, if not in a firm seed-bed and suitably covered with soil, will frequently germinate and die. In fact, failure with clovers may be attributed mainly either to seed-beds unsuitable because of their lack of firmness or to sowing at an unsuitable period when the conditions are too severe—*i.e.*, too early in the spring or too late in the autumn.

Pasture Establishment.

Under a wide range of conditions pastures may be sown successfully in September. As companion crops readily may compete injuriously with infant pastures for light and nutritive materials, generally the most successful pasture establishment takes place when the pasture is sown alone. Should it be considered advisable for a special purpose to grow a companion crop, the rate of seeding of the latter should be substantially less than if it were to be grown alone—the heavier the companion the more severely is the young pasture likely to suffer. And the longer the young pasture is subjected to competition from a companion crop the more is it likely to suffer ; hence cereals sown with pastures should be utilized for silage or chaff rather than for grain. This is of especial importance in the drier districts, in which the drain of the cereal on the summer supply of soil-moisture may prove very harmful to the young pasture. Because of the danger of injury associated with them the use of companion crops is more undesirable with seed mixtures intended to produce permanent pastures, which, because of their longer life, reflect any setback for a greater period.

In the spring establishment of pastures harm at times results from sowing too early while the severe conditions militate against vigorous growth from the outset and thereby lead possibly to stunting of growth and to increased trouble from weeds if they do not lead to the loss of valuable seedlings, such as those of clovers.

The application of phosphates to young pastures at or shortly after the time of sowing is usually advisable economically. There is some evidence that the use of sulphate of ammonia on newly established pasture may deleteriously affect the establishment of clover. If the soil is known to benefit from liming, then the use of lime at the time of the sowing-down of a pasture may be expected to be advantageous. In some districts established pastures undoubtedly benefit from applications of potash, but whether the application of potash at the time of pasture-seed sowing is advisable has not yet been ascertained by the Department of Agriculture.

Management of Established Pastures.

Top-dressing of established pastures in September may be expected to bring about increased growth, but whether such top-dressing is advisable depends upon not only an increase in yield, but the necessity for such an increase. If the increase in yield merely adds to a supply of feed adequate for all requirements up to Christmas, including ensilage and haymaking, then September top-dressing is not likely to be advisable—it would probably be better to defer the top-dressing until late summer. But if the top-dressing to date may not allow adequate reserves of hay and silage to be

secured, then September top-dressing may be well justified. Generally, areas to be closed for silage or hay should be top-dressed just before they are shut up, if fertilizer has not been applied to them fairly recently. All material, such as wire, timber, &c., likely to cause delays or breakages in mowing should be removed at the time of closing up the fields.

Probably in September some pastures still require harrowing; usually further delay in the harrowing of pastures in which stock have fed during the winter is harmful. Further, fields to be utilized for hay or silage during the coming summer should be harrowed thoroughly just before they are closed from grazing.

If pastures suffering from the ravages of grass grubs are not so extensively damaged as to be beyond repair, then, as far as practicable, the feeding-out of hay, roots, and silage should be carried out on them. The feeding-out of hay made from overmature material is likely to be particularly useful in this respect, as it often contains viable seeds of valuable pasture species, and these seeds may substantially strengthen a weakened open sward. When the greater portion of the valuable plants in arable grassland have been destroyed by the grass grub, then usually the best course is to plough the land as the initial step towards the eventual resowing of it. In this connection it is well to bear in mind that grass or cereal crops cannot with safety follow a crop in which there has been considerable grass-grub infestation. Further general information relative to the grass grub and its control is contained in Bulletin 159, which the Department supplies free on application.

Pasture-seed Mixtures.

In recent years valuable advances have been made in the knowledge relative to the composition of pasture-seed mixtures. As the advice offered to farmers frequently ignores these advances, farmers should take the necessary simple steps to assure themselves that the seed mixtures they use conform with the best available current knowledge. A common weakness relative to pasture-seed mixtures originates in false economy, which is grievous, because it begets an initial weakness which leads to a reduction in returns enduring probably as long as the pasture itself. One of the matters involving serious false economy is the use of inferior strains of such important constituents of permanent pastures as perennial rye-grass, cocksfoot, and clovers. Reliable supplies of seeds of superior strains are made available by the official seed-certification measures. Each year becomes marked by increased evidence that even at the higher prices it is true economy to use certified seed in the establishment of permanent pastures. For general use seed belonging to the cheaper "permanent pasture" grade is eminently suitable, but when the production of certified seed is contemplated, then the use of "mother" grade seed is essential. It is unquestionably false economy to use seed poor in respect to germination or purity—in fact, it is but ordinary common sense to ascertain the guaranteed purity and germination capacity of all seeds purchased, including certified pasture seed: lines of certified in common with those of uncertified seed are likely to vary considerably in germination and to some extent in purity. Sometimes farmers lower their outlay by unduly reducing the amount of cocksfoot used. This may be due in part to the fact that the amount of cocksfoot used for permanent pastures in the past often has been too small. Widely in New Zealand, including land on which one should aim to build up a sward in which rye-grass and white clover are prominent, cocksfoot is of outstanding value from December onwards in providing feed during the summer period, in which rye-grass and other useful species make but scant growth. At times the tufty habit of cocksfoot has been intensified by the small number of plants in the pasture due to the use of insufficient seed. Generally the minimum amount of cocksfoot that should be used is 10 lb. an acre, and the amount that may be used advantageously

rises to 15 lb. for conditions more suited to cocksfoot than to rye-grass—*e.g.*, in dry conditions on the east coast of both Islands, apart from fields in which the production of rye-grass seed is an important consideration. Detailed information about seed mixtures for specific purposes and conditions is available from local officers of the Fields Division. The composition of various typical mixtures suitable for conditions obtaining in extensive portions of the Dominion is given in these notes in the February *Journal*.

Provision of Special Feed.

Associated with grassland, a most valuable source of cheap feed, is a weakness of basic importance. This weakness lies in the fact that in late summer and again in winter and early spring the production of feed from grassland declines sharply. While this fact is well known, the practical measures necessary to remedy the difficulties it creates are frequently neglected. In dairying, pastures often begin to prove inadequate from Christmas onwards, and, frequently with unfortunate results, feed provision seems to be based on the belief that this does not happen until February. Good management designed to keep the pastures leafy may delay to some extent the feed-supply becoming inadequate, but, even then, the summer feed shortage often occurs on dairy-farms earlier than the supplementary feed becomes available to meet it. Even though the summer feed from pastures is adequate in quantity, it is likely to be lacking in quality—too woody or fibrous, and consequently too indigestible and too poor in mineral matter. In the warmer districts the position may be remedied by crops of green maize and millet, provided they are consumed in the young leafy stage. Soft turnips are so highly digestible that they are of outstanding value, particularly if, as so often happens in summer, grass or other feed, such as green lucerne, has been allowed to become somewhat mature and woody. The aftermath on pastures cut early for silage or hay is also apt to give useful supply of summer green feed when that available from the fields under grazing is becoming undesirably scant.

For use in the winter period mangels, carrots, chou moellier, swedes, and turnips are all suitable, and could profitably be grown much more extensively. Except in the more severe and Southern districts, mangels give very attractive returns when accorded good fertility and good cultivation. Being practically free from attacks of any serious disease and able to withstand dry periods relatively well, they are very reliable; and when suitably treated are characterized by heavy yields an acre of nutriment. Swedes and turnips may suitably replace mangels when the good treatment advisable for mangels cannot be readily provided. Carrots are suited to free, fertile soils, on which, as has been thoroughly demonstrated in Taranaki farmers' competitions, really attractive yields can be obtained. Chou moellier has rightly become popular in recent years for use on good ground, and especially on ground that is likely to be so wet at the time of feeding off as to make the satisfactory use of swedes somewhat difficult. Chou moellier, because it is distinctly resistant to club root, is also suitable when the ravages of this disease are at all likely.

Consideration of the crops to which reference has been made is opportune, because, in general, cultivation for all these crops should soon be in progress if it has not already commenced.

Another crop that specially calls for consideration at this period is lucerne. Lucerne is of outstanding value as a source of feed for use when the feed directly available from grassland is below requirements; the first cut converted into silage and other cuts possibly into hay provide excellent feed for winter use, while even in very dry seasons successful stands of lucerne usually provide substantial amounts of highly digestible green feed at a time when there is special need for such feed. Reference to the management of lucerne at this season was made in these notes last month.

Ensilage.

In recent years ensilage has rightly become so popular that there is now a much smaller need for general information about either its role in our farming or its manufacture, but there is still scope for its profitable extension for the purpose not only of building up reserves of feed to be used during critical periods of pasture shortage, but also of controlling pasture growth more efficiently in November and December. At times silage may usefully be fed to stock in September. In the case of cows in milk two facts should be kept in mind—

(1) Silage as commonly made, by itself, does not constitute a ration which allows cows of heavy yield to produce to their maximum capacity; this is because of the amount of woodiness which commonly characterizes the material from which silage is made.

(2) In the feeding of silage to cows in milk some care must be taken to obviate tainting of the milk; silage should not be kept close to the place of milking or of storing of milk and cream; the person or clothing of milkers should not be permeated with the odours of silage. Experience has shown that simple precautions of this nature eliminate all risk of dairy-produce developing silage taints.

Cultivation Work.

In view of the fact that August is usually an extremely busy time in respect to cultivation operations, it is advisable to bear in mind that often more harm than good may result from the working of wet soils. Just how wet a soil may be cultivated without injury depends to a considerable extent upon the nature of the soil—sandy soils may be worked practically at any time, while great care must be taken not to work, when they are too wet, soils in which clay is a prominent constituent. Frequently old grassland may be ploughed with safety when adjacent land, similar except that it has been under the plough for some time, could not be worked without injury to its texture. Usually the cultivation of land which is so wet that it adheres to boots and implements does not prove fully satisfactory.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Cultivation.

SPRING may be regarded as the commencement of the busy period of each season's orchard activities, therefore orchardists are recommended to bear this fact in mind and plan ahead the necessary work to be carried out, with a view to completing each operation in its proper season. In fact, successful orchard management can be achieved only by following this practice.

It is presumed that the winter operations as outlined in previous notes in this *Journal* will have been completed. The main activities for the coming months will be confined to cultivation, spraying, manuring, grafting (where necessary), thinning, and finally the harvesting and packing, &c., of the next season's crop.

The importance of thorough cultivation carried out in its proper season cannot be overstressed, and orchardists in their own interests should pay as much attention to this work as to spraying, &c., because fruit-trees will not thrive unless the roots have a free run in sweet soil.

Under the heading "Cultivation and Manuring," in the May notes, it was recommended that autumn or early-winter ploughing be carried out by throwing a furrow up to each row of trees, thus bringing the finishing furrow, which acts as a temporary drain, midway between the rows of trees. This ploughing should be followed up as early as soil conditions will permit in

the spring by striking out a furrow midway between the rows of trees, thus filling in the finishing furrow or temporary drain formed by the autumn ploughing. It is advisable to plough up to within a reasonable distance of the trees, and the plough should be reduced to a depth that will avoid cutting and damaging tree-roots. At this ploughing set the plough to a depth which will avoid turning up any green matter or manure which may have been ploughed under during the autumn. The land about the trees untouched by the plough should be dug or grubbed, and all vegetation turned under. After ploughing, the soil should be brought to a fine tilth, as soon as possible, by means of disks or harrows.

The third and final ploughing for the season should be done as early as possible in September, when the orchard may be cross-ploughed at about the same depth as the previous ploughing. It is recommended that each day's ploughing should be harrowed the same day in order to eliminate the risk of excessive drying-out of the soil where such is likely to occur. Subsequent cultivation will consist of harrowing, &c., which should be continued until about the end of January.

Manuring.

Nitrogenous fertilizers, such as sulphate of ammonia, nitrate of soda, &c., may be applied about the beginning of September, or when signs of growth movement become apparent. Care must be taken, however, not to apply too heavy a dressing—generally a dressing of 1½ lb. to each tree may be considered a liberal one.

Grafting.

The reworking of trees by grafting may be undertaken at any time from the "green tip" period to about the middle of October. The scions require to be kept in a dormant condition. If the trees to be grafted were previously cut back for grafting, it will be necessary, just prior to inserting the scion, to make a fresh cut. To insure a good "take" make clean cuts, bind scion to stock carefully with raffia, apply grafting-wax or other suitable preparation to protect the exposed tissues from drying out and to prevent rain-water from gaining access to the graft until the scion and stock have united. For detailed instruction relative to this matter see Vol. 47, No. 2, page 122, of this *Journal*, August, 1933.

Seasonable Spraying.

At time of writing, indications point to an early spring; therefore growers are advised to anticipate this occurrence by having the spray pump and materials in readiness for spraying. The following may be taken as a general guide for the various normal growth movements of pome-fruit trees: Tight cluster stage, about 20th September; pink cluster stage, about 7th October; petal fall stage, about 19th October; calyx closes stage, about 30th October.

—*J. W. Whelan, Orchard Instructor, Palmerston North.*

Citrus Notes.

During the next few months cultivation will be an important part of the operations in a citrus orchard, and every reasonable attention should be given to this work. Cultivation of the soil has several advantages, and should be carried out in an intelligent manner in order to obtain the best results. Some of the advantages of cultivation are:—

(1) It prevents evaporation by reducing the conductivity of heat and also by breaking the capillary tubes in the soil through which the subsoil moisture escapes.

(2) By letting the air into the soil, it enables the beneficial bacteria to work more fully.

(3) The finely cultivated surface absorbs and retains any moisture that may fall, and during periods when the rainfall is limited this is of great importance.

(4) It is a means of keeping down weed growth, which, during the spring and early summer, is not beneficial to the trees.

There are perhaps some growers who do not understand how moisture can be conserved by cultivation. Turning over the soil on the surface certainly causes it to become drier and gives the impression that the operation only assists the moisture to escape. However, the fact is that the broken layer on the surface acts as a blanket through which moisture can only escape slowly.

Whether cultivation should be shallow or deep is a matter for individual judgment, depending largely upon the nature of the soil and the depth of the roots. Where soils are somewhat heavy, cultivation should be deferred until the soil is in a suitable condition. However, where the soil is of a sandy nature the same care is not necessary, as there is little danger of packing either the soil or subsoil.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Seasonable Reminders.

It may be well to reiterate that the end of next month, or, at any rate, early October, may generally be regarded as the end of the correct season for hatching out chickens. Even with the lighter breeds, such as Leghorns, the birds will not lay till the spring if brought out later than the end of September. It is always better to hatch out somewhat early rather than somewhat late. Remember that the laying year ends with the moult, so that the late hatched birds have no opportunity, having regard to the short season available, of producing a good egg-yield during the pullet year. Not only do they lay during the season of cheap prices, but they are likely to involve one in constant trouble with disease and parasitic infestation, and, further, they never make good breeding-stock.

There is yet ample time to hatch out ducklings for the renewal of the laying flock, but early September should see all the eggs undergoing the process of incubation for the production of ducklings for the Christmas market. To cater for this trade, the eggs should be put down about fifteen weeks before the young birds are to be marketed. This will allow twenty-eight days for hatching, the natural time, and the remainder for rearing the birds to prime condition. It is always a wise course, whether it be with table ducklings or poultry stock intended for the Christmas trade, to market the birds at least a few days before the festive season sets in. In this way those poulterers who cater for the best trade are given an opportunity of preparing the birds for market, and placing them in the freezer to await the rush. A point in regard to ducks is that they should be mated some time before the eggs are required for hatching purposes, or a high percentage of infertile eggs may be expected. Ducks, particularly the heavy breeds, usually have to be mated much longer than fowls in order to secure a high percentage of fertile eggs.

Feeding Chickens.

A correspondent who paid a visit to the Wallaceville Poultry Station during last Christmas week, in expressing his appreciation of the condition and general appearance presented by the chickens of various ages seen in the process of being reared, is anxious to know how the young birds were fed. Mr. H. A. Kitto, the Overseer, has furnished me with some details

regarding his method of feeding from the time the chicks are placed under the brooder until a matured age is reached, and particulars are given below.

While proper temperature, ventilation, and cleanliness are among the chief factors in raising brooder chicks, the matter of providing the right class of food is also imperative, and must not be overlooked. Numerous mixtures have been tried at this Station. Experience goes to show that the main point is to feed nothing but sound wholesome food, and that the manner in which the food is supplied is almost as important as its quality.

During the past two seasons a plain, simple ration, without the addition of any prepared mixtures, condiments, stimulants, &c., was provided, and this gave highly successful results.

The chicks are transferred from the incubator to the brooder after dark. The following morning, say, from thirty-six to forty-eight hours after hatching, they receive their first meal. For the first eight days the required food is taken from the following mixture. Finely broken wheat, 70 lb.; finely broken maize, 20 lb. The chicks are fed three times a day—viz, in the early morning, mid-day, and about one hour before dark. At first only a few minutes are allowed the chicks to feed. The food is provided on flat trays with low sides, the trays being removed as soon as the chicks appear to be satisfied. Special care is taken not to overfeed the chicks during the early stages, particularly during the first week. It has been found a good plan to slightly underfeed rather than to overfeed during the early stages. The required quantity of mixed dry broken grains it is intended to feed daily during the early brooder stage are placed in a basin, slightly moistened with hot water or milk, and allowed to steam some time before being fed, a plate being placed over the basin to keep the steam from escaping. This causes the grains to swell, and thus prevents them doing so in the chick's crop. Fresh clean water is made available to the chicks to drink when provided with their first meal, and is left before them at all times for the first four days. From then onwards fresh or skim milk is used in place of water and left before the young birds at all times during the brooder stage, which generally lasts from six to eight weeks according to prevailing weather conditions. From the eighth day to the eighth week a mash is provided for the morning and mid-day meals, a broken-grain ration, as referred to above, being fed in dry form for the evening meal. The mash is made up of 2 parts wheatmeal and 3 parts bran, moistened with sour milk and mixed to a crumbly condition but not sloppy. After the eighth week and until the pullets show signs of nearing a laying-point a mash mixture is fed for the morning and midday meals. This consists of wheatmeal, 2 parts; pollard, 1 part; and bran, 3 parts; moistened as before described.

A grain mixture as follows provides the evening meal: Wheat (whole), 2 parts; shelled oats, 2 parts; barley (hulled), 2 parts; maize (broken), 1 part. When it is observed that pullets are showing signs of prematurity, say, at about four months old, and in order to check this, the use of milk for moistening the morning mash and as a drink is reduced by degrees by way of adding water thereto until milk is eliminated from the ration, only hot water being used for moistening the mash, and cold water given as a drink. When the great bulk of the young birds commence to lay they are given a ration similar to that given to the adult laying flock. The morning and noon meals consist of mash made up of wheatmeal, 3 parts; pollard, 2 parts; bran, 4 parts; each by measure; to which from 5 per cent. to 12 per cent. by weight of the entire mixture of meatmeal is added, according to the birds' laying condition. At this stage the ingredients of the mash are generally moistened with hot steamed lucerne. For the evening meal a grain ration as follows is fed: Barley, 6 parts; wheat, 2 parts; maize, 3 parts. The manner in which the birds appreciate the different kinds of grains is always taken into consideration, and when it is

observed that they are leaving any particular grain and showing a disinclination for it, this is provided in reduced quantity. When the birds become settled down to egg-production, meatmeal, in addition to that included in the mash, is placed in a hopper and left before the birds at all times to pick at as they choose. Right from the start stone-grit, broken oyster shell, and charcoal are always in front of the little birds. The important point of keeping the chicks well exercised throughout all stages of their development is not overlooked. This is induced by scattering some broken wheat, &c., in the litter and making the chickens scratch and hunt for the grains. Another way of inducing exercise is to tie up some green material sufficiently high to make the chickens jump to secure it. For the first week green food such as finely cut silver-beet, green oats, &c., is fed in combination with the moist grain ration, the former being merely sprinkled over the latter. From the end of the first week onwards green material is fed separately and in abundance—viz., for the first meal in the early morning, again at about 2 p.m., and after the grain ration provided in the evening. Special care is taken that all green material fed is tender and succulent, and not coarse or hard fibrous growth. If chicks are supplied with long pieces of fibrous substance when very young, it is apt to become a tangled mass, and will not leave the gizzard, with the result that death is likely to take place. All grains are broken or ground into meal as the case may be on the plant, and to a size suitable to the age of the chickens to which it is to be fed.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Breeding.

Colonies in normal condition should now have a good quantity of sealed brood in the combs, and young bees emerging every day. The queens should be laying well, though not up to their full capacity; but their powers in this direction will increase with the approach of warmer days. The first bees bred this season will act as field-bees, and the older autumn-bred ones will die off rapidly. Breeding should be kept going steadily without a break, as it is necessary that each colony should grow in strength in order to be in a condition to take advantage of the first flow from the early nectar-secreting plants.

Food and warmth are the main factors in promoting steady breeding, and these should have constant attention. It is well to remember that when breeding is in full swing a considerable amount of food is used up every day for feeding the brood. All through the spring when weather conditions are favourable some nectar can be gathered, and often a considerable amount, which helps to supplement the stores in the hive, is stored. However, there are times when, through bad weather, the bees are unable to do this. Where such conditions last for several days the food-supply will diminish rapidly, and the bees may be reduced to starvation before the beekeeper is aware of their condition. August and September are critical months in this respect, and if a spell of bad weather is experienced it is well to ascertain the condition of the food-supply in each hive, and feed without delay where necessary.

Hints to Beginners.

There are a few points which every beekeeper should bear in mind when starting an apiary. The stocks must be clean and in good condition. No beekeeper can hope to succeed with poor bees, and no one but a novice would tolerate other than strong colonies. The hives should be well made and painted; cracks and knot-holes may be of use for ventilation in the

summer, but at any other time of the year they absorb much of the bees' time in gathering propolis to stop the draughts; moreover, any holes besides the entrance offer an inducement for robbers to investigate, and necessitate the bees employing extra guards to prevent attack. A careful watch should be kept on the stores, so that the bees may not starve. It is far better to overfeed than underfeed, for, as already indicated, it is amazing how quickly a colony will deplete its stores when brood-rearing commences in the spring. More feeding means more brood; but, once commenced, it must be continued until the hives show actual proof that they are gathering sufficient nectar to keep themselves going. Feeding should be done only in the evening, inside the hives, and it is advisable to use a syrup in the proportion of 2 parts water to 1 part sugar, to dissolve it thoroughly, and feed it as soon as it has cooled sufficiently to be harmless to the bees.

It is well to provide permanent shelter; a live hedge is the best if kept trimmed to a height of 8 ft. or 10 ft.; failing this, some kind of breakwind is essential. The hives should never be exposed to high winds, as, in addition to the danger of the roofs being blown off, cold draughts check brood-rearing to a very great extent.

The hives should be opened only on warm, still days, and necessary observations made and noted as quickly as possible. The inside of the cover makes a good rough diary, and does not get lost or mislaid; mark the date of each examination. One should endeavour to distinguish the sex of the brood at a glance, and keep a sharp lookout for the queen; she is easily distinguished by the length of her body and the comparative shortness of her wings. An effort should be made to make a rough estimate of the weight of each frame as it is lifted by comparing it with that of an empty comb and thereby arriving at some idea of the quantity of stores in each hive. It is unwise to try to run many hives until the rudiments of the business have been grasped—it is well to be content with one or two strong colonies until the learner's stage has been passed.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Vegetable Crops.

On sandy lands by the seashore, sea-kale is a perennial crop that is easily grown; such localities in Europe are its natural home. As the crop is harvested in the spring, it is of special value, as there is usually but little variety at that season. It may be grown from seed or root cuttings. Seeds may be sown now in rows 1 ft. or so apart and the plants thinned to a distance of 6 in.; they will then be ready for planting out permanently after twelve months' growth; this is done at a distance of 2 ft. between plants and 2½ ft. between the rows. Root cuttings give a quicker return; they are made from pieces of root about the thickness of a pencil and about 4 in. or 5 in. long. It is convenient to cut the tops square across and the lower end with a slanting cut. These should be planted out now in rich ground well prepared in an open position, where the crop should produce well for five years or more. The top of the cutting should be 2 in. below the surface of the ground. A number of growths will appear from each cutting, but all should be removed except the strongest. Occasional applications of nitrate of soda will bring the plants along strongly. The crop has a fairly wide range of adaptability, and need not be confined to the localities mentioned. When planting out seedlings now the crown of the root must be cut off or the plant will produce a flower stem, which should never be allowed. A number of growths from the one plant will develop, but they should all be removed except the strongest—as is done with root cuttings.

The plants die down in the winter, when the beds should be cleaned up. Before growth recommences in established beds, each plant should be covered with a box or pot to exclude the light: a tender blanched growth 8 in. or 10 in. long is the result. This always should be cut with a portion of the crown of the root, and the plant then allowed to grow naturally, the shoots being thinned, leaving only one or two of the strongest to complete its growth. To do this satisfactorily a good dressing of manure should be applied and worked in during early summer.

A dish of moderate-sized leeks well grown has very much the flavour and attractions of good asparagus. It is a very hardy crop and subject to very few troubles of any kind. It is a reliable crop in fairly rich land in any climate. To produce plants for setting out towards the end of the year in land from which an early crop has been cleared a generous sowing should be made now.

The most delicious of the cabbage family are the Brussels sprouts, and very fine crops are now being grown here in the cooler districts. As they require rather a long season to complete their growth, they are sown thinly towards the end of September, and planted out about the month of November in a piece of ground which has been well manured and cultivated and from which an early crop of peas, &c., has been taken. To obtain the firm solid sprouts that are desirable good thrifty growth is necessary, and this is obtained by planting them out in ground that has become consolidated and has not been recently dug. An application of nitrate of soda or sulphate of ammonia may be made when the plants have become established, but it is to be remembered a too generous application of manures will be detrimental.

The popularity of green peas demands a generous supply, to maintain which a sowing of a mid-season variety should now be made. A rich, moist soil in which lime and phosphates have been included suits them best.

Main crop potatoes are usually planted during the months of September and October. While a rich, light loam is most suitable for the crop, it is often planted in rough land newly broken in, with a view to cleaning it and bringing it to a fine tilth For this purpose the potato crop is very suitable. Rough dirty ground is quite unsuitable for fine seeds, and, while it may not grow a heavy crop of potatoes, a potato crop will be as good as can be expected and equal to or better than any other that might be obtained from land in that condition. In addition, the hoeing, moulding, and digging will aerate and sweeten the land as well as destroy the weeds. It is for these reasons that the crop is popular for assisting in breaking in new lands.

The fundamental requirement of successful cropping of any kind is good seed. This is more than usually difficult to obtain in the present case owing to degeneracy, bad storage, or disease. Virus disease especially is dangerous, as infected tubers may not show the least sign of it. In the absence of known reliable stocks it is best to obtain potato seed certified by the Department of Agriculture after careful examination during the growth of the crop and at the time of digging. Whole seed is safest to plant but large tubers may be cut so long as each piece has one or more strong eyes. Cutting also permits a more thorough inspection, which is an advantage with doubtful seed. Cut seed should be sown at once; if this is not possible spread cut seed on a floor and cover with wet sacks. On small areas planting may be done as digging proceeds; on larger areas the land is sometimes marked out with a sledge or other marker and the tubers set with a hand planter or grubber; more usually in such cases the seed is ploughed in about 4 in. deep. A practice too frequently followed is to allow the crop to take care of itself after sowing until the plants are well above the ground and a strong crop of weeds is established. Better growth and clean ground will be secured by harrowing the land about a fortnight after planting, to break up the crust and destroy weeds, repeating

the operation as necessary until the potatoes are up. Then one deep cultivation between the drills should be given, followed by shallow working as may be necessary and gradual moulding-up, which should be completed as the crop commences to flower.

In warm humid localities where early potatoes may be grown, but late crops are seriously subject to disease, kumaras are very good substitute for the latter. They are grown from slips produced from tubers sprouted on a hotbed. After making up the hotbed and allowing it a few days to settle down, spread 1 in. of clean sand, then sound kumara tubers close, but not touching. Then cover to a depth of 4 in. with clean sand or sandy loam. Water the bed thoroughly with a water-can, and keep it moist; but great care is necessary in this, and it is safer to keep it rather on the dry side. In four or five weeks the tubers have sprouted, and when the shoots are 6 in. in length they should be removed carefully. At this stage they should have sufficient roots to sustain them. They should then be heeled closely, in a well-sheltered sunny position, and provision made so they may be readily covered should there be any danger of frost. Here they harden off and make root in readiness for planting out from the middle to the end of November. A sandy loam well sheltered is ideal for planting out this crop.

As the value of fresh salads is now generally appreciated, radishes and lettuce should be sown. And for those who appreciate a variety of vegetables salsify may be sown 1 in. deep in rows 15 in. apart. It has few enemies, and provides a generous crop of roots for winter use.

Where interest is taken in herbs, seeds of coriander, caraway, angelica, dill, aniseed, summer savory, and sweet marjoram may be sown; the latter must be treated as a half-hardy annual, the remainder are quite hardy. Cuttings, with a heel of old wood, of sage, rosemary, lavender, and thyme may be taken and rooted in a moist sandy soil. Spearmint, peppermint, tarragon, and chives may be propagated by division.

Tomatoes and other half-hardy crops sown in boxes which are placed on a hotbed towards the end of August should be pricked out into other boxes as soon as they are big enough to handle. No artificial manure should be used with the soil; if it is poor a little fine bone-meal may be added. The boxes of seedlings should be returned to the hotbed and watered with tepid water through a fine rose. When the plants are established it is advisable to ventilate freely in fine weather and encourage steady growth in moderate temperatures.

Tomato Crops under Glass.

In the unheated glasshouse this crop requires close attention at the present time owing to the changeable weather. Much has been said about the need of ventilation and a dry atmosphere for this crop under glass, but the remarks apply chiefly to the early summer period when the house is crowded with growth. There is little danger from excessive humidity now, and a cold draught may seriously retard the crop. During the springtime ventilators must be adjusted with every change in the weather so that steady growth is maintained; and when late frosts threaten a few heaters of some kind should be at hand to meet the emergency. It is advisable to avoid forcing growth when the lower bunches are setting, and to assist them, if necessary, by jarring the strings on which the plants are trained, by rapping them smartly with a light cane or by drawing the cane quickly along the rows of twine; this should be done about noon in fine weather. Shallow cultivation to break up the surface crust and destroy weeds is beneficial, and tepid water should be applied during the morning as required. Sturdy plants with plenty of blossom is the object in view; rank, soft growth, and poor setting is often due to high temperatures, excessive watering, and a loose rich soil.

Small-fruit Crops.

Light cultivation to destroy weeds and encourage growth should be given as may be necessary. Deep cultivation must be carefully avoided at

this season or irreparable damage will be done to the fruit crop. Established plantations from which heavy crops are expected will generally benefit from a dressing of fertilizers worked in about the time growth commences.

The planting of all hardy crops of this class should now be completed at the first opportunity during fine weather. Those crops which are inclined to be rather tender during the early stages of growth, such as passion-fruit, tree tomatoes, and Cape gooseberries, may be planted towards the end of October.

The Homestead Garden.

New lawns should be trimmed as soon as the grass is long enough for cutting; use a mower that is in good order and set it high, generally as high as possible. Cut the lawn when the grass is dry and afterwards roll it with a light roller. When old lawns become thin and weedy it is usually due to a lack of fertilizing treatment. Applications of 3 parts sulphate of ammonia and 1 part of sulphate of iron are a popular dressing to suppress the weeds, but it is also necessary to manure the grasses and obtain a vigorous growth, when weeds will have little chance of again becoming established. On light land a rich dressing of complete manure of organic origin is most suitable. It should be in a dry friable condition so that it may be easily spread and may quickly work down to the roots of the grasses. On heavy land the dressing may be composed chiefly of artificial fertilizers well mixed with sharp sand. Early spring is the most suitable time for making these applications.

Rose-pruning should now be completed. Cut away the weak wood on young plants and shorten the remaining growth to 3 in. or 4 in., cutting just above buds that are pointing in an outward direction. This is considered destructive by those who are unaccustomed to the work, but it will not be long before the treatment is justified by growth far exceeding that on bushes of the same age which have been pruned lightly. The bushes also will be more shapely, besides having other important characteristics.

Prick off half-hardy annuals out of seed-boxes, setting the young plants down almost to the seed leaves. Firm the roots in the ground, but not the stem at the surface; it is very tender and liable to serious injury.

The decorative character of many pot-plants make them very desirable ornaments at times; they are also most economical if they are used understandingly. Palms, *Begonia rex* varieties, aspidistras, asparagus species, and ferns dislike much sun, and should be given shady situations. Warm sunny positions are suited to geraniums, pelargoniums, and members of the cactus group. All pot-plants soon show signs of distress if fresh air is lacking, and cold draughts are equally injurious. The water used should be of about the temperature of the atmosphere, so it is often advisable to "take the chill off" in cold weather. Where potting or repotting is necessary, it is generally best done about the month of September. It is usually done satisfactorily, but improvement may sometimes be made by seeing that the roots of the plant to be operated on are moist, but not very wet. The plant should be repotted a day or two after watering. After setting the plant in a fresh pot, water it in, but withhold water afterwards until growth recommences and more water is obviously required. Results depend very much on the soil mixture used; most of the plants above mentioned require rather a rich soil with plenty of humus (decaying organic matter, chiefly vegetable, such as leaf-mould) and sand to keep it open and prevent it setting hard. Equal parts of good loam, leaf-mould, and sand will suit most of those above mentioned; with the addition perhaps of a little fine bonedust. Where the soil is light, it is usually advisable to increase the loam ingredient and halve the quantity of sand used. Geraniums and pelargoniums should be potted firmly in a soil composed of 3 parts good loam, 1 part decayed manure, a little coarse sand, and rather generous addition of bonedust.

—W. C. Hyde, Horticulturist, Wellington.

WEATHER RECORDS: JULY, 1934.

Dominion Meteorological Office.

DURING July there was a predominance of southerly winds, but except for those on the 4th, 17th, and 27th, they were usually not severe. The month, however, was a cold one.

Rainfall.—Rainfall distribution during the month was somewhat irregular. The greater portion of the country experienced less than the average amount, the largest deficit being in Canterbury, where, at places, less than half the normal fell. North Auckland, Otago, and Southland, and districts about Cook Strait, on the other hand, had considerably more than the average.

Temperatures were everywhere below the average. In the North Island the mean difference was 1°·5 below, the recording station showing the greatest difference being Taihape, where it was 2°·2 below. The South Island mean was 1°·9 below average, Christchurch and Hanmer Springs having the largest departures, with 2°·8 and 3°·8 respectively. The low mean temperatures are accounted for by the prevalence of southerly winds and the unusually cold night temperatures in the clear weather accompanying them. Frosts were frequent, some inland places in the South Island experiencing the most severe ever recorded.

Sunshine.—Fortunately there was more sunshine than the average at most places, New Plymouth being the only one with a deficiency. Blenheim had the highest total—viz., 195·9 hours—while Nelson had 191·6 hours and Tauranga 163·7 hours.

Pressure and Weather Systems.—The storm systems during July were somewhat similar in type to those ruling in June with a tendency for the areas of lowest pressure to pass over the North Island.

The disturbance, which was responsible for the widespread snowfall at the end of the previous month, was on the 1st July still located east of New Zealand. By the morning of the 2nd, a secondary depression had formed west of Cook Strait, and during the night of the 2nd it passed over the North Island. The southerly, consequently, continued to be severe during the following two days, much snow falling in both the North and South Islands.

On the 7th a cyclonic depression which had, during the previous two days, been centred off the New South Wales coast, was covering the greater part of the Tasman Sea. Its effects were already being felt from Canterbury northwards, strong north-east to east winds being accompanied by widespread rains. Very heavy rain fell in the North Auckland District on the night of the 7th, totals of over 5 in. being recorded at some places for the twenty-four hours preceding 9 a.m. on the 8th. As a result, there was some heavy flooding. The storm had disappeared eastwards by the morning of the 9th, and, owing to the development of an intense depression over south-eastern Australia, the southerly in its rear was quite a mild one.

Other depressions causing fairly general rains crossed the Dominion on the 16th, 21st, and 27th respectively. The two former were of the westerly type, but the one on the 27th was a complex one with a centre which crossed northern New Zealand. Heavy rain was associated with it in North Auckland and strong north-east to south-east winds blew.

Most of the disturbances referred to were responsible in their later stages for snowfall on the ranges, while at the beginning of the month and again on the 16th a considerable amount fell on the low lands. Canterbury received a fairly substantial coating during the night of the 16th, when a boisterous southerly prevailed.

Interspersed with the storm areas mentioned, there were various though brief periods of fine weather associated with passing high-pressure systems. For instance, it was fine generally from the 5th to 6th, 13th to 14th, 17th to 20th, on the 25th, and during the last three days of the month.

RAINFALLS FOR JULY, 1934, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.	Total for Year to Date.	Average for Year to Date.
	North Island.					
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	8·44	17	2·96	5·48	33·93	33·64
Russell	10·22	15	4·83	5·27	43·01	32·60
Whangarei	8·75	17	4·73	7·19	37·33	38·79
Auckland	5·97	19	2·42	5·06	32·78	27·05
Hamilton	5·99	21	2·13	5·10	27·87	29·00
Rotorua	5·25	13	2·82	4·98	32·60	31·85
Kawhia	3·66	16	1·00	6·01	30·61	31·55
New Plymouth ..	4·96	22	1·70	6·39	31·33	34·85
Riversdale, Inglewood ..	9·04	20	1·85	10·06	47·49	58·71
Whangamomona ..	3·75	9	1·07	7·27	37·66	42·97
Hawera	3·42	14	0·59	4·22	24·50	25·61
Tairua	5·33	9	2·50	6·31	33·74	39·87
Tauranga	4·63	14	2·64	4·89	33·46	31·57
Maraehako Station, Opotiki	3·81	11	1·11	4·45	27·61	32·24
Gisborne	4·29	12	1·86	5·05	17·48	29·96
Taupo	3·26	13	1·10	3·87	25·87	25·23
Napier	2·39	12	0·68	3·81	18·70	22·52
Hastings	1·98	11	0·63	3·66	15·88	20·29
Whakarara Station, Kereru	4·23	8	1·60	..	31·73	..
Taihape	3·35	18	1·02	2·98	28·06	20·69
Masterton	3·50	17	1·38	4·20	20·46	23·03
Patea	3·20	16	0·65	4·23	24·10	25·63
Wanganui	2·34	17	0·53	3·34	21·04	21·04
Foxton	4·39	11	1·65	3·11	20·45	18·38
Wellington	6·10	20	2·04	4·71	26·92	25·00
	South Island.					
Westport	6·15	16	1·08	8·30	54·41	54·80
Greymouth	5·82	16	0·78	7·93	56·36	57·49
Hokitika	8·29	16	1·71	8·74	55·41	63·90
Ross	7·59	11	1·99	9·18	69·00	71·95
Arthur's Pass ..	7·93	5	3·30	9·93	85·23	85·87
Okuru, South Westland	7·58	9	2·00	10·52	..	82·56
Collingwood	10·88	14	5·05	9·40	50·69	54·96
Nelson	3·81	9	2·25	3·46	20·45	21·76
Spring Creek, Blenheim	2·94	11	1·95	3·42	16·68	17·89
Seddon	3·13	8	1·00	2·40	16·34	14·72
Hanmer Springs ..	3·34	8	1·90	4·37	34·45	25·98
Highfield, Waiau ..	2·05	4	1·16	3·34	23·27	20·08
Gore Bay	1·65	5	0·60	2·80	24·60	18·67
Christchurch	1·25	12	0·51	2·67	17·81	15·60
Timaru	0·77	7	0·29	1·88	17·68	12·96
Lambrook Station, Fairlie	1·08	4	0·50	2·62	18·58	14·60
Banmore Station, Clearburn	0·81	10	0·30	1·74	14·56	14·54
Oamaru	1·96	7	0·55	1·72	14·83	12·70
Queenstown	2·47	11	1·07	2·02	18·56	17·30
Clyde	0·97	7	0·31	0·90	12·37	8·66
Dunedin	2·96	12	0·66	3·00	24·58	21·13
Wendon	2·63	15	0·65	1·74	18·54	17·22
Balclutha	4·17	17	1·00	1·78	21·99	14·49
Invercargill	4·51	22	0·61	3·28	26·46	26·45
Puysegur Point ..	7·47	27	0·49	6·15	41·12	48·41
Half-moon Bay ..	5·61	26	0·78	4·40	29·10	33·53